AIRLINER
COLOR HISTORY

McDonnell Douglas MD-80 & MD-90

hur Pearcy

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MBI Publishing Company

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In Memoriam
Arthur Pearcy, respected around the world for his aviation writing, died during the production of this book. He will be remembered as an enthusiastic supporter of aviation and for his unparalleled recording of the history of Douglas aircraft, particularly the DC-3.

Seen in picturesque European winter surroundings, MD-82 PH-MBY while under lease to Martinair. Note the inscription on the engine nacelle reads 'DC-9 Super 80'. *AP Photo Library*

CONTENTS

INTRODUCTION

This is the fascinating story of the latest members of the Long Beach, California family of ultra-modern airliners which today are serving airlines around the globe and will continue well into the 21st century.

Construction of the former McDonnell Douglas MD series airliners is now confirmed by new owners Boeing to continue into the year 2000, with a new model on offer to carry forward the Long Beach tradition.

$1.1trillion of world-wide investment in new airliners is projected up until the year 2015, with the world total up from 11,066 airplanes today to 23,080. From 2001 to 2005, the average investment is predicted at $50billion, and after that is expected to increase as the world airline fleet grows from 16,300 in 2005 to the 2015 total.

In the forecast world airliner fleet, products from what is now the Douglas Products Division of Boeing are included in three of the small airliners categories. The veteran DC-9-10 is listed in the 50-90 seat category, and the subjects of this book, the later MD-81/82/83/88 and the MD-90 are included in the 121-170 seat category.

The airline industry continues its recovery despite world-wide competition as new models are developed. Load factors are up and profits are on the rise. Since the jet era began, world air travel has been a growth industry. Expanding business, trade, and wealth drove that trend. Looking forward two decades, the experts forecast similar air travel growth: projected traffic increase will be approximately 5.1 percent per year. More and more countries are expected to benefit from economic development and general integration into the global economy. As trade expands, businesses prosper, wealth grows, and demand for air travel increases, the future is forecast to follow much the same path as the last 20 years. World air travel will grow, faster than wealth itself.

As competition continues to intensify during the next 20 years, market forces will continue to foster change in the world's airline industry. Airlines will confront an increasingly competitive environment. Broader liberalisation of markets will continue. Long-term profitability will depend on the successful development of cost reduction strategies.

BELOW: AOM's F-GGMB seen in summer 1996 livery. AOM is the major domestic carrier in Mexico, serving over 40 cities, as well as scheduled services throughout the USA and internationally across the Atlantic to Europe. The company was privatised in April 1988 after the state-owned airline, Aeronaves de Mexico, was declared bankrupt. *A.P. Publications*

AIRLINE FLEET NEEDS CHANGE

A number of strategies, influenced by differences in traffic growth rates among major markets, will produce a marked change in the composition of the world airline fleet. With intermediate-size airplanes predicted to account for over 21 percent of the world fleet by 2015, (up from 17 percent in 1995) one can see reflected the great flexibility and increased capability offered by airline manufacturers in the form of families of intermediate-size airliners, with increasing choice between types available.

New airplane models contribute to improvements. Modern airliner families such as the Douglas/Boeing MD-80, MD-90 and MD-95 (or 717) provide design-in range capability which offers airlines operational flexibility. They offer commonality benefits which reduce crew costs. New airplanes require less

maintenance, are more reliable, and offer greatly improved fuel efficiency. Reservations can now be made on personal computer networks and savings in flight operations are also possible. Straight-line routings available from satellite-based navigation will save both time and money.

INTERMEDIATE-SIZE AIRPLANE MARKET

World market demand and airplane supply requirements appear annually in carefully researched market data documents published and circulated by most aerospace companies such as Boeing, McDonnell Douglas and Airbus Industries. The mix of new additions by 2015 will be 68 percent single-aisle, 22 percent intermediate-size and 10 percent large airplanes. The worldwide freight fleet will be 2,260 airplanes in 2015. The general indications are that the airline industry is in a state of recovery and that airline capacity is now in line with demand.

During the first half of the 1990s, the airlines were confronted by the disruptive effects of the Gulf War on economic growth and air travel. At the same time, they were introducing large amounts of new capacity. The combination of slow growth and this increase in capacity led to significant industry operating losses. However, by 1993 the airlines began recording operating profits, and by 1995 they had increased year-over-year orders for new airplanes for the first time in the decade.

The early 1990s can best be characterised by the imbalance between capacity and demand. The slowdown in the world economic growth coincided with the delivery of a record number of airliners. Airlines had ordered these planes during the boom years of the late 1980s, but by 1990 excess capacity existed within the industry. The number of parked airplanes in desert outposts located at Mojave, California and Kingman, Arizona, reflects the magnitude of this excess, doubling from 500 in 1990 to 1,000 (or even more) in 1991. This parked fleet grew to 1,110 over the next two years.

However, by 1995 this same parked fleet had decreased by more than 370 airplanes, leaving approximately 730 in the desert park by the end of the year. Based on historic levels in relation to the total world fleet, at least 275 are needed to support the used airplane market. These are 26 or even more years old, and are expected to return to active airline service as an alternative to new factory airplanes.

NOISE

Noise deadlines are having a severe effect on the airliner order outlook. Legislative requirements to retire or make quiet is known as Stage 2 airplanes, this introduces uncertainty into the near-term outlook for airplane orders, primarily from Europe and the USA. These requirements encompass a large number of airplanes — 3,600 worldwide in 1995. Airlines face three choices: they can replace with new airplanes; they can hushkit or re-engine old airplanes; or they can remove the offending airplanes from the fleet and not replace them. Which choices are made by the different airline companies will affect airline capacity and orders over the next five years.

Indications are that European airlines will not hushkit airplanes as extensively as US operators. Individual airports in Europe have more influence in determining noise and emission requirements. To complicate matters, some selected airports specifically exclude hushkitted airplanes, making fleet planning more difficult.

Half of the US Stage 2 airplanes will be hushkitted making the USA the primary potential market. At the end of 1995 there were 2,090 airplanes in the US Stage 2 fleet. Already 13 percent are hushkitted to meet Stage 3 requirements. The current projection — based on the announced intention of the airlines — is that another 35 percent will be hushkitted.However the balance of the fleet is forecast to be replaced primarily because of age. The MD series airliners are well placed to take advantage of this situation.

AIR TRAVEL

World air travel is forecast to grow by 70 percent in 10 years. By 2005, airlines will need to carry 2,700billion revenue passenger miles per year, and — though recent economic problems may change the outlook — economic and travel growth from the Asia-Pacific region has been forecast to dominate. The world commercial jet fleet capacity should reach 3,600billion available seat miles by 2005. This air travel growth drives the demand for more capacity and additional airplanes.

The world airline fleet mix continues to change, while airlines select the airplane size and range combination that suits their strategies and minimises financial risk. To prosper in a very competitive marketplace, airlines will increasingly select fleets which give them the flexibility they need to serve their markets — which is why two thirds of the airplanes expected to be required over the next 20 years will be single-aisle types.

The very detailed monthly *Douglas Aircraft Inventory Status* for June 1996 lists 875 DC-9s in service with 71 operators, 1,138 MD-80s with 55 operators and 17 MD-90s with four operators. By March 1997 there were still 869 DC-9s operated by those 71 operators, while 1,135 MD-80s were being flown by 56 operators and the MD-90 had increased to 46 with 10 airlines. It is historically interesting to recall that a total of 976 airliners in the DC-9 series were built, the last one, a DC-9-32 for the US Navy being delivered on 28 October 1982.

Today, single-aisle airlines dominate short flights. The current world fleet of 8,200 single-aisle airplanes is expected to increase to 11,700 by the year 2005. The utilisation of single-aisle airliners will possibly decline from today's share of 74 percent to 72 percent, or even lower, of the world fleet. Despite the need for large numbers of single-aisle airplanes, their share of the world fleet declines. Markets served by these airliners are possibly not growing as rapidly as markets where larger airplanes predominate.

ASIA-PACIFIC

Single-aisle airliners in the Asia-Pacific area are concentrated on domestic routes. Because of the area's geography they make up a small share of the regional fleets. In the same areas, regional flows are longer haul, and airport capacity is constrained. As a result of this, though the region accounts for 14 percent of world revenue passenger miles, it accounts for only 9 percent of the world's single-aisle fleet. Subsequently these airplanes will continue to provide a smaller share of capacityin the Asia-Pacific area than those in Europe and North America, being used for shorter regional markets and for domestic flights.

The exception will be China, where it is forecast that rapid traffic growth and system expansion will drive the requirements. There air travel is expected to increase at nearly twice the Asia-Pacific average and, consequently, China's domestic market will be among the world's largest markets for single-aisle airliners over the next two decades.

There is no doubt that the domestic United States is the world's largest market for both air travel and single-aisle airliners. Deregulation some 17 years ago dramatically changed airplane requirements. Linear route structures changed to efficient hub-and-spoke networks, (although not all US airlines have developed hub-and-spoke systems) with hub carriers offering the frequencies needed to dominate spoke cities. As hubs are expanded, smaller cities can be added, increasing regional dominance. These frequency-orientated strategies shifted airplane requirements from larger, low seat-mile cost airliners to smaller types with low trip costs. Ageing wide-body airplanes have been perceived as financially risky, thus most of the remaining wide-body fleet has been transferred to international services, sold, or parked in desert storage.

EUROPE

Travel within Europe is the second largest market for single-aisle airliners. Historically routes between most European cities were flown cooperatively by the two national flag airlines and domestic markets were often monopolies for the national airline. European airlines generally met their need for increased capacity with larger airplanes, similar to the USA before deregulation. Recently, liberalisation has opened up the European market by limited market sharing agreements. The airlines are revising their strategies; major airlines are adding new routes from their primary hubs and adding frequencies on established routes. Competitive pressures comparable to those the US airlines experienced are being felt in Europe. Many are reducing the number of twin-aisle airplanes in their short-haul fleets and adding single-aisle airliners. Continued liberalisation in Eastern Europe will surely lead to more competitors in many markets.

The introduction of high-speed rail services is likely to cause a decline in air travel to some capitals in Europe. This will lessen the requirement for twin-aisle airliners. Charter airlines carry approximately half of intra-European traffic and account for about a third of the airplanes. These airlines require airplanes that combine low seat-mile costs, low trip costs, and good field performance and range capability. It is forecast their needs will continue to be best met with the slightly larger single-aisle models.

Intermediate-size airplanes should be the fastest growing segment of the market for commercial airplanes. There are two reasons for this. First, these airplanes are gaining in range capacity. This allows them to serve more inter-continental markets. Second, regional traffic growth will drive markets served with larger single-aisle airplanes up to intermediate-size. Over the next decade, the share of intermediate-size airplanes is projected to increase from 17 to 19 percent. A total of 1,460 deliveries are projected over this 10 year period.

Arthur Pearcy

RIGHT: One of American Airline's fleet of MD-80 series airliners departing into a storm-ridden sky. Today AA operates the largest airline fleet of any single type in the world outside the CIS. By July 1997 American operated 234 MD-82s and 26 MD-83s on its extensive route system across the USA. There was a time when, if all its commitments to the MD-80 series had been exercised, the fleet could have reached a staggering 350 to in jet airliners. *AF Photo Library*

1 EVOLUTION

THE DC PEDIGREE

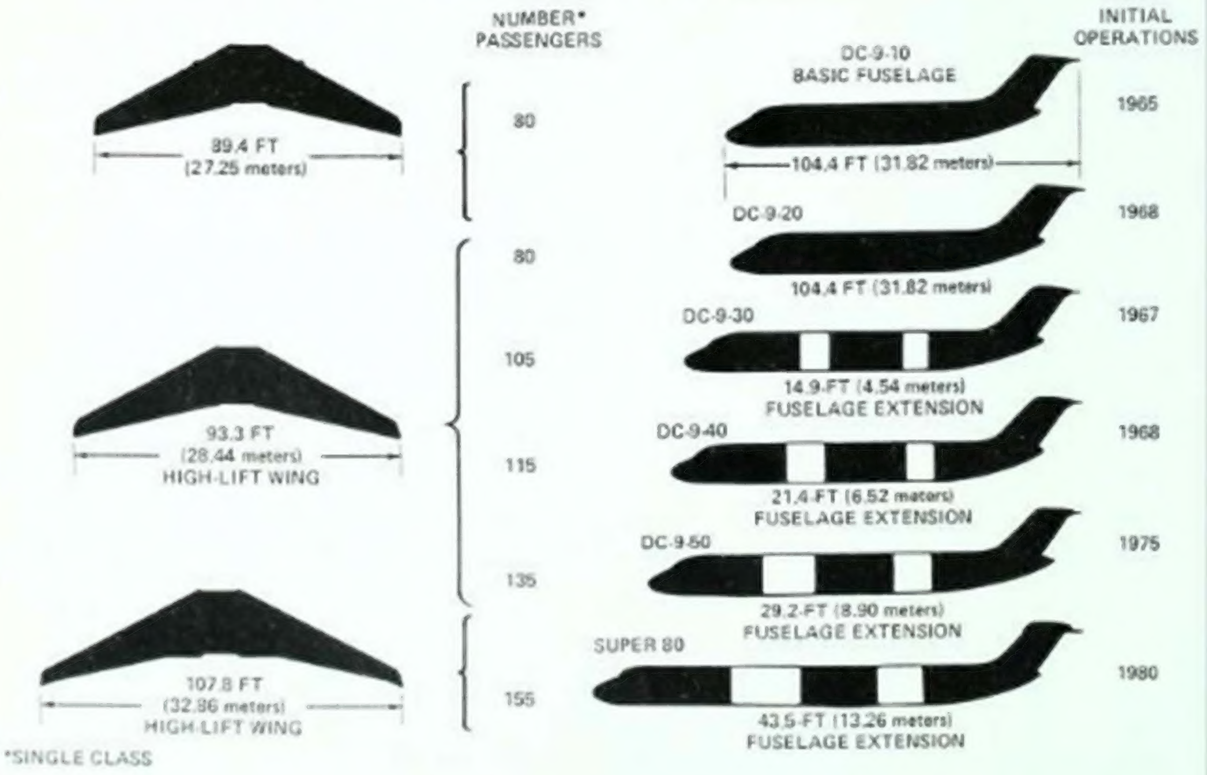
During the annual Douglas Aircraft Company stockholders' meeting held during April 1966, just days before Boeing announced the first order for its 747, an official of the California-based company confidently stated that it was in 'one of the most satisfactory phases of its 47 years' history.' He was, in fact, entirely mistaken.

Faced with rising costs, labour shortages, delays in delivery by key suppliers and the urgent need to expand its production facilities, the Douglas company lost control of its costs. Earnings which had been expected to reach about $20million during the fiscal year 1966, gave place to a deficit, after tax credits of $27,330,067. With a substantial backlog of orders, the company had hoped to obtain sufficient additional working capital and, while attempts were made to raise $50m of equity capital, Douglas negotiated with its bankers for an increase in its credit. Following the bankers' advice, Douglas then approached the Wall Street firm of Lazard Frères to obtain assistance in finding a solution to the problem.

Lazard Frères moved into Douglas's Santa Monica plant, and used it as a headquarters in order to assist in sorting out various offers of financial assistance and direct merger. On 9 December 1966 Lazard Frères made it clear that, in their professional opinion, a company merger was necessary and that what Douglas needed was not only capital but also a new management. Merger offers were received during the next few weeks from Fairchild, General Dynamics, Martin Marietta, McDonnell, North American Aviation and Signal Oil & Gas.

From these offers, that made by McDonnell of St. Louis, Missouri, was unanimously recommended on 13 January 1967,

DC-9 FAMILY GROWTH



ABOVE: Aerial view of part of the large Long Beach plant showing Lakewood Boulevard dividing the huge establishment, which dates back to World War 2. The huge administration building, housing the corporate headquarters, and the vintage manufacturing halls are on the left. Across the boulevard are the buildings erected to cater for the DC-8, the DC-9 and DC-10. Today they house the production lines of the MD-11, MD-80, MD-90 and MD-95 series. Overflying Long Beach is a 1943 USAAF C-47 transport, the military version of Douglas's ubiquitous DC-3, returning home for a visit in June 1985. *Douglas*

LEFT: The strength of the DC-9 design was its flexibility. From the earliest days it proved straightforward to 'stretch' and, consequently, would go on to become the second most numerous series of passenger jets. *Douglas*

by the joint negotiating committee Douglas had set up along with Lazard Frères to advise the Board of Directors of the ailing company. The offer made by the McDonnell Company consisted of the immediate purchase of $68,700,000 of 1.5 million new Douglas common shares and then, should the proposed merger be approved by the US Justice Department, all shares of Douglas stock would be exchanged for one and three-quarter shares of McDonnell common stock.

Its is interesting to reflect that four years earlier, James S. McDonnell, Chairman of the McDonnell company, had acquired 300,000 shares of Douglas common stock. He approached both Donald W. Douglas Snr and Donald Douglas Jnr with a merger proposal, offering one share of McDonnell stock for two shares of Douglas common stock, but the plan was soundly rejected.

But in 1967, US government approval followed swiftly, as continuation of operations by the Douglas Company was important to sustain the war effort in Vietnam and, on 28 April, the Douglas Aircraft Company Inc. gave its name to the McDonnell Douglas Corporation — MDC.

LONG BEACH

The new MDC management brought a backlog of DC-9 deliveries back on schedule, and the airliner kept its hard-won status as the world's best-selling twin-jet airliner through the early 1970s.

The DC-9's history was tied up with that of the famous Douglas plant at Long Beach. Taking advantage of a huge World War 2 aircraft building programme launched by the US government, Douglas had organised a wholly-owned subsidiary, Western Land Improvement Co. which undertook the construction of a new plant adjacent to the Long Beach Municipal Airport. During November 1941 the new Long Beach plant was ready to begin operation and the first aircraft constructed there was a Douglas C-47-DL Skytrain, delivered on 23 December, 1941, just 16 days after the United States entered the war.

In June 1955, Douglas had announced itself ready to enter the jet transport world, and was rewarded on 25 October when Pan American World Airways announced an initial order for 25 DC-8 airliners. For the first 11 months after that historic order, the Douglas DC-8 order book was ahead of that for the Boeing 707.

However, the facilities at Douglas's Santa Monica plant were inadequate for the company expansion that was required. The runway was far too short and it was surrounded by a residential area that opposed major noise disturbance. Capitalising on its existing facilities at Long Beach, and on the willingness of the municipality to enlarge, the Douglas company announced in April 1956 the construction of new facilities on a 55-acre site adjacent to the existing plant on the other side of Lakewood Boulevard. It was initially intended only to house the new DC-8 production line, and was anticipated to cost $19million complete with all the fittings and machinery. The actual cost proved much higher — in 1957 alone the company spent some $30,800,000 for property, equipment etc. This amount just exceeded the net income of $30,665,252 realised during that year.

The new building consisted of two large production halls, linked by a central core of offices and covering a grand total of 1.14m sq ft, over 26-acres. The west hall — 1,144ft long, 480ft wide and 57ft high — was for major sub-assembly, fabrication of wings, fuselage barrels, cockpits etc. It contained three bays spanning 160ft each. The east hall was the same length but the height was 67ft with two bays 160ft and 200ft wide respectively accommodating a 12-position assembly line for the DC-8. After the aircraft passed the sixth position it was transported outdoors, where the fuselage was pressure-tested to 12.33psi (lb per sq in) then returned to the assembly line. May 1957 was the target date for building completion and a further addition was a separate facility erected nearby for painting the airliners' exterior.

While both Douglas and Boeing were developing their respective commercial jets, the world's airlines had been experiencing a period of rapid growth. There were increases in passenger-miles of 17.3 percent in 1955, 16.4 percent in 1956 and 14.7 percent in 1957, while the economy of the nations in the western hemisphere was progressing rapidly. However, when the Boeing 707-120 and the Douglas DC-8-10 entered service in October 1958 and September 1959, respectively, airline traffic had slumped with the passenger miles growth rate being only 4.9 percent. This resulted in follow-on orders for both the Boeing 707 and Douglas DC-8 not reaching their anticipated rate.

Both airliners initially failed to achieve their guaranteed range, resulting in further funds being spent to correct the deficiency. The problems resulted in a sharp reduction in DC-8 sales from 73 in 1955, to 40 in 1956, 10 in 1957, 11 in 1958, 18 in 1959 and only three in 1960. Net income of the company unfortunately kept dropping, from the second highest profit figure of $33,202,304 achieved in 1956, to $16,847,028 in 1958. This was the year during which the company recorded its all time net sales record of $1,209,920,338. In 1959 it recorded its second net loss of $33,822,229. Douglas again recorded a net loss in 1960, of $19,429,437, but profitability returned in 1961 when a net income of $5,956,909 was achieved.

TWIN-JET STUDY

The market data research division of Douglas was busy reviewing a potential market for a short-range jet airliner, and had in fact commenced a series of design studies of the type. It was February 1963, after a net profit of $10,205,248 had been achieved in 1962, that the Douglas management authorised detailed engineering work on the design of a twin-jet airliner, and in May 1963 the sale of 15 new airliners known as the DC-9 was announced to Delta Air Lines.

Production of the DC-9 was conceived as an original risk-sharing programme involving other manufacturers in an intricate network of plants. The nose of the airliner was built at Santa Monica, the wing and tail assemblies by de Havilland of Canada, fuselage panels by Aerfer in Italy, whilst various other

RIGHT: The parallel final assembly lines at Long Beach plant during 1986 when the DC-8 and DC-9 were in production. Today the same huge building is occupied with the final assembly of both the MD-80 and MD-90 Series of twin-jet airliners. Swissair is one of the companies oldest customers dating back to the 1930s when it purchased Douglas DC-2s which were sub-assembled by Fokker. *MDC*

components were manufactured in the USA. The Long Beach plant was responsible for the production of the fuselage and final assembly. Initially this operation took place on a single assembly line producing jointly the DC-8 and the DC-9. The DC-9 achieved great success and in 1965 alone 170 of the twin-jet airliners were sold and by the end of 1966 total sales reached 424 aircraft.

What was initially a joint DC-8, DC-9 production line at Long Beach was replaced by a single DC-8 production line and two parallel DC-9 lines. A new subsidiary, Douglas Aircraft Company of Canada assumed responsibility for the production of both wing and tail assemblies for the DC-9. Douglas leased and operated portions of the de Havilland (Canada) plant located at Malton, Ontario with effect from 1 December 1965.

By the spring of 1978, sales of the Douglas DC-9 series airliner had reached 976, with the last a military Series 32-C9 BuNo 161530 completed on 26 August 1982, f/n 1084 s/n 48166, being delivered to the US Navy on 28 October.

Any further orders came under the new nomenclature DC-9 Super 80, or DC-9-80 — later this airliner was called MD-80, and so a new airliner family (or at least a new generation) began.

TOP: The competition — the Boeing 737, the most successful jet of all time. This is a Boeing 737-300, a series that went into production in March 1981. A re-engined 737-300, it had structural and aerodynamic improvements adapted from the Boeing 757 and 767. The JT8D-engines were replaced by larger CFM-56 engines using a redesigned nacelle. Here at San Francisco on 26 July 1995 is Western Pacific 737-301 N301AU which first flew on 15 May 1986. The paint scheme features the popular cartoon *The Simpsons*. *Ed Davies*

ABOVE: An historic photograph taken on 30 July 1988 at Long Beach showing TWA MD-83 N9304C, c/n 49530 f/n 1397, with vintage DC-2 NC13940 also in TWA livery from the Douglas Historical Foundation. The airline, then Trans Continental & Western Air, received its first DC-2 on 14 May 1934. By March 1997 TWA was operating a total of 30 MD-82 and 24 MD-83 airliners plus no less than 58 of the earlier DC-9 series. *Douglas*

ABOVE RIGHT: Stablemate of the MD-80 and MD-90 was the stretched DC-10 — the MD-11. Its launch had been frustrated by a sharp fall in airline traffic and internal problems at Long Beach. It was 17 months before sufficient orders were obtained from a dozen airlines to enable the MD-11 programme to be launched on 30 December 1986. Depicted is the 47th MD-11, N211MD, which first flew on 26 April 1990. An MDC release dated August 1997 claimed 32 customers in 24 countries with 372 commitments. However, by December 1997 the MD-11 was only serving 21 customers, operating a total of 171 aircraft. *Douglas*

RIGHT: Between 1965 and 1982 a total of 976 DC-9s was built at the Long Beach plant, the last being delivered on 28 October 1982. Depicted is the fourth DC-9, N1301L, completed for Delta Air Lines on 24 May 1965. *Douglas*

2 DESIGN

DESIGNING THE 'SUPER 80'

Each succeeding airliner design has to fly more safely and more efficiently that its predecessors. Each innovation that introduces better performance to aircraft normally results in more work and more complex systems for engineers to design. Today they are helped by computers, which permit rapid and accurate analyses of proposed aircraft changes and improvements. New tools enable designers to check more aspects of each design than was possible before, but the engineers' workload remains about the same.

However, the combined and concerted effort of a large team of design specialists was required to produce a major new derivative such as the DC-9 Super 80 airliner. With the first prototype scheduled for flight testing in mid-1979, approximately 500 engineers were employed in designing the many new systems and components which distinguished the Super 80 from its predecessors.

At MDC the team were involved in determining what elements the customers desire in an aircraft, before assessing the feasibility of producing the new design. Market data research was heavily involved in forecasting the world needs over the next few decades as regards airline growth and demand. The team also had to decide what to change and what to retain in the new design.

With 976 DC-9s already delivered by 1982, the company planners had plenty of ideas supported by the reliability of the basic DC-9 design before they commenced the task of designing the Super 80. In reviewing feedback from the many airliners and operators, apparently several themes were continually repeated. The need for a more economical, more fuel-efficient and much quieter airliner in the DC-9 category that could carry more passengers was most often expressed. Determining that one could be built with the required range and economies was the task of MDC Advanced Engineering.

ADVANCED DESIGN

Over several months a relatively small team of advanced engineers studied the many potential configurations. After looking at a number of possible fuselage enlargements, the engineers concluded that a 14.3ft (4.36m) 'stretch' over the DC-9 series 50 was optimum for increasing passenger and cargo capacity and lowering direct operating costs.

They determined that if the new, quieter, Pratt & Whitney JT8D-209 engine would be ready in time it would meet both noise and performance guarantees. Higher take-off gross weight was a requirement to give the Super 80 the desired range with its increased payload.

The designers also knew that a wing change would be necessary in the new airliner. A particularly significant and deep study involved the potential benefit of using a super-critical wing on an improved DC-9. Because the Super 80 was not a long-range aircraft, the study team concluded that the super-critical wing was not cost-effective, so its benefits did not justify inclusion in the new Super 80 design. Instead they determined that adding to the wing root and wing tip as well as improving the simple and efficient DC-9 high-lift system, would provide at reasonable cost, the increased fuel capacity, and range they were seeking.

A wing root enlargement was designed to increase the Super 80's wing area and fuel capacity. A 2ft wing tip extension was added to increase the wing aspect ratio of the DC-9 to aid performance. Larger trailing-edge flaps were designed for lower stall speeds, plus an immediate extension position for the leading edge slats for low drag on take-off and for better climb out characteristics at the Super 80's higher gross weight. The improved high-lift system, the wing area and the more powerful new engine were planned to enhance the performance of the new Super 80. Combined with the larger fan of the 'dash 209' engine which would reduce noise as well as aid performance, these features alone would dramatically reduce the noise impact on hostile areas in the vicinity of airports.

The DC-9 Super 80 was forecast to be the quietest commercial jet-liner when it went into service during 1980. Once the advanced designer had achieved a basic Super 80 configuration and performance profile, a huge marketing effort was launched worldwide to assess the chance for success. Results showed high interest in the Super 80 with an excellent market potential. On this basis and with sufficient initial orders in hand, the MDC management announced the start of the Super 80 programme in October 1977. Even before then, company engineers were planning for an orderly transition from Advanced to Design Engineering.

DETAILED DESIGN

Detailed designs based on concepts developed by advanced designers had to be prepared. Super 80 Chief Design Engineer Mike O'Connor coordinated the work required of engineering specialists in structure, aerodynamics, avionics, environmental

ABOVE RIGHT: The MD-80 flight test crew go on board N980DC for its first flight on 18 October 1979. The 909th twin-jet airliner off the Long Beach assembly line, it flew from Long Beach to Yuma, Arizona, where MDC had its flight test facilities. Flight trials proceeded smoothly until 17 December when the airliner ran into problems during a departure stall manoeuvre. *MDC*

RIGHT: With the prototype MD-80 in the background, the flight test crew are seen posing prior to first flight. Chief Engineering Pilot H. H. 'Knick' Knickerbocker, in the centre, was involved with the new airliner programme from its inception. Virginia 'Ginny' A. Clare was the 'Super 80' flight test engineer and John Lane the project pilot. *MDC*

stems, power plant, mechanical, human factors, materials and ocess, interiors and structures analysis, who were working th advanced design engines so that they would be ready to sume responsibility once the Super 80 programme was unched.

It was up to these specialists to turn the preliminary design ncepts into 'nuts and bolts' engineering drawings. More than ,000 such drawings were required for the Super 80. ranslating something from an idea to a drawing is not easy. metimes the cycle has to be repeated several times before the sign is finalised. Once released, each drawing must then be viewed by tooling, planning and manufacturing specialists ho decided what tools must be made to produce the new part nd how the new part or system is to be integrated into the anufacturing process.

Design feasibility is reviewed at a variety of points:

. By the check group at the drawing stage.
. In the construction of system mock-ups for complex new areas.
. By the computer-aided design techniques.
. By planning and tooling people who catch fit or 'go-together' problems.

Once parts are built they are subject to many tests, which sometimes result in redesign.

Finally, in the prototype Super 80 flight tests, other engineering improvements were suggested. Four key men in advanced design of the new airliner were RT Eathorn, Principal Configuration Engineer; AJ Testa, Senior Configuration Engineer; HC Funk, DC-9 Project Engineer; and CJ Shepard, Project Configuration Engineer.

Thousands of working hours by hundreds of MDC engineers were required to produce the Super 80. Add to that the thousands of hours involved in simulation and the testing required for new designs. Senior engineers with hundreds of man-years of experience supervised the new design, many of whom had been heavily involved with the successful design of the DC-9 since its inception. This engineering innovation and diligence plus the input from millions of hours of DC-9 operation were combined to ensure that the Super 80 would maintain the enviable passenger appeal, profit potential and reliability of the DC-9 family.

ABOVE LEFT: Wind tunnel tests on a 7% scale model of the MD-87 twin-jet airliner undergoing low-speed testing in the Central Technologies Research Center wind tunnel at Longueuil, Quebec, Canada. Standard on the MD-87 was the 10in (25.4cm) extension to the vertical stabilizer to retain the excellent handling characteristics of the MD-80 series. Also shown is the redesigned extended tail cone standard on all MD-80s as from 1986. It reduces drag and saves fuel. MDC

CENTRE LEFT: The MD-80 has a longer fuselage and greater wingspan than previous DC-9 series, carrying up to 172 passengers. The aircraft is registered N9608C. MDC

LEFT: The DC-9 Super 80 seen on one of its test flights. When it entered airline service in October 1980 it became the quietest jet airliner in the skies. Its operating costs and fuel consumption per passenger continue to be the lowest of any aircraft in its class. MDC

MODELS

A low-speed wind tunnel model [illegible] for the Super 80 in the 12ft wind tunnel at the National Aeronautics and Space Administration's (NASA) Ames Research Center located south of San Francisco to determine how well the new airliner would meet its design objectives. Data collected from Ames and other wind tunnel tests [illegible] paid off with improvements and modifications to produce more capacity, lower noise levels, good economics and reduced fuel consumption.

A wind tunnel model can cost upwards from several hundred thousand dollars, and is built to determine how the real airliner will function in take-off, landing and cruise configurations. High-speed models are made almost entirely of metal with sensors to determine cruise performance. Low-speed models have movable surfaces such as flaps and ailerons to simulate take-offs, landings and other flight phases. Testing at low speeds is also conducted with flutter models; these are built of balsa wood and fibreglass over aluminium spars. Weight distribution in the models simulates conditions anticipated in the real aircraft.

During testing, the flutter models are exposed to a constant airflow, but are jolted or excited to test the damping characteristics of the design. Wind tunnel models range from relatively simple preliminary models for use early in the programme, to highly sophisticated models which obtain and confirm final design details. Experience has shown that a high degree of correlation exists between wind tunnel tests and flight tests in full-scale aircraft. In all more than 1,000 hours of Super 80 testing were completed. A similar programme was coordinated for the later MD-90 and MD-95, all derivatives of the successful Super 80, known today as the MD-80.

HISTORY OF STRETCH

With the exception of the enigmatic DC-8, the trend with each and every model of Douglas Commercial transports was to be larger than its predecessor. This long lasting tradition of stretching the fuselages of its airliners goes back to 1934 when the original 12-seat Douglas DC-1 (Douglas Commercial) was stretched into the 14-seat DC-2. This was followed by that of the DC-4 into the DC-6 during 1946; the DC-6A in 1949; DC-7 in 1953 and DC-7C in 1955 at the end of the propliner era. One must not forget the ubiquitous DC-3 which was re-built as a Super DC-3, with stretch, in 1949.

By the mid-1970s the MDC subsidiary in Long Beach, still known and respected as the Douglas Aircraft Company, had become the almost undisputed champion of [illegible] through fuselage lengthening. The company was keen to keep its privileged role as the world's leading supplier of commercial transport aircraft and a challenge from Boeing with the Boeing 707-80 prototype jet transport could not be ignored. On 16 May 1958, the first Douglas DC-8 [illegible] came the stretched DC-8 [illegible].

By this time the first Douglas DC-9 [illegible] on 25 February 1965. This [illegible] ers immediately became [illegible]

compare. The Series 10 which was 109ft 3in (33.30m) long was stretched to 119ft 6in (36.39m) to become the Series 30 in 1966. It was further stretched to 130ft 7in (39.82m) to become the Series 40 in 1967, and then stretched to 150ft 7in (45.90m) to become the Series 50 in 1974. Overall length and maximum certificated seating capacity had been increased 37.4 percent and 54.6 percent over corresponding figures for the initial DC-9-10.

The DC-9-50 was already representing a far greater stretch than had previously been achieved without airframe but the Long Beach design team knew that the successful DC-9 could be stretched even further to achieve still better seat mile costs. However, at this time an increasing concern over all forms of air pollution was activating most regulatory agencies in the United States to plan stricter regulations on noise and air pollution in general. The MDC design engineers also knew that another stretch of the DC-9 fuselage would either entail a significant reduction in range, or require quieter and cleaner engines. Fortunately for the future of the DC-9, and as it later turned out, for the future of the Long Beach production line of airliners, timely development by Pratt & Whitney of relatively cleaner (than successful JT8D turbofan series) opened up a complete new line of development.

FLIGHT TESTING

When the prototype MD-80 first flew on 18 October 1979 it had a unique flight test engineering crew on board. Chief Engineering Pilot H. H. 'Knox' Knickerbaker was pilot-in-command. He had been involved with the MD-80, or DC-9 Super 80, programme since its inception. He joined Long Beach in October 1961 later becoming Project Engineering Test Pilot for the DC-9 Series 50 and supervised all flight operation activities relating to engineering flight testing for both commercial and military programmes.

John P. Lane was the DC-9 Super 80/MD-80 Project Pilot. He joined the company in May 1966, completing the DC-9 ground school, flight and instructor pilots course earning an Airline Transport Pilot's certificate with a rating on the DC-9. As an engineering test pilot he flew the DC-9-50 flyover noise meet, DC-9 NASA Retan programme, DC-9-80 certification programme, and DC-9 runway development programme.

Flight Test Engineer for the MD-80 was Virginia 'Ginny' Clare, who joined Long Beach in January 1969 as aerospace engineer on the DC-10 programme. In June 1979 she was assigned flight engineer to the prototype MD-80, after being promoted in May 1978 to the position of flight test engineer with flying status.

The engineering flight test trio, along with many others were involved with the new airliner from the day the decision was made at Long Beach to produce the MD-80 on 20 October 1977. It was then known as the DC-9 Super 80. Production began in 1978 with the machining of the first wing spar, and assembly of the initial nose section was underway by September 1978. The maiden flight on 18 October 1979 lasted 2hr 50mins. The flight test programme that followed leading to certification involved some 1,685 hours of flying time. The new airliner was certificated by the FAA on 25 August 1980, with first delivery to an airline taking place on 12 September 1980 and the new MD-80 entered commercial service on 5 October 1980.

The first flight of the MD-90 took place on 22 February 1993 with N901DC (c/n 49818 s/n 53387), the flight crew being Chief Test Pilot William Jones, Test Pilot H. B. 'Bee' Smith and Flight Test Engineer Barry McCarthy. Other Long Beach based flight test teams included John F. Miller and Douglas Moss, both engineering test pilots who have been involved in several first flights of MDC aircraft. Tom Melody is another engineering test pilot involved in MD-87 and MD-88 certification programmes. Fred Schreiner, Jack Bonyun and John Groves, have all logged many flight test hours including production and test flight engineering programmes.

Below: The DC-9 Super 80 lifts off the runway at Long Beach on its maiden flight on 18 October 1979. Later designated MD-80, it was heralded as the first of the new technology jet airliners. (MDC)

3 PRODUCTION

As has already been discussed, when McDonnell and Douglas merged, it was decided that the facilities at Douglas's Santa Monica plant were inadequate for the company expansion that was required. The runway was far too short and it was surrounded by a residential area that opposed major noise disturbance. Capitalising on its existing facilities at Long Beach, and on the willingness of the municipality to enlarge the Douglas company announced in April 1966 the construction of new facilities on a 55-acre site adjacent to the existing plant on the other side of Lakewood Boulevard.

The new building consisted of two large production halls, linked by a central core of offices and covering a grand total of 1.1 million sq ft, over 25 acres. The west hall — 1,040 long, 480ft wide and 50ft high — was for major sub-assembly fabrication of wings, fuselage barrels, cockpits etc. It contained three bays spanning 160ft each. The east hall was the same length but the height was 67ft with two bays 160ft and 80ft wide respectively accommodating a 12 position assembly line for the DC-8. This is where the MD-80 and MD-90 are put together, although, as is usual these days, the components come from far and wide.

MDC CHINA PROGRAMME

An historic aviation co-production agreement was signed in April 1980 linking McDonnell Douglas Corporation and the General Administration of Civil Aviation of China (CAAC) in an interesting series of activities.

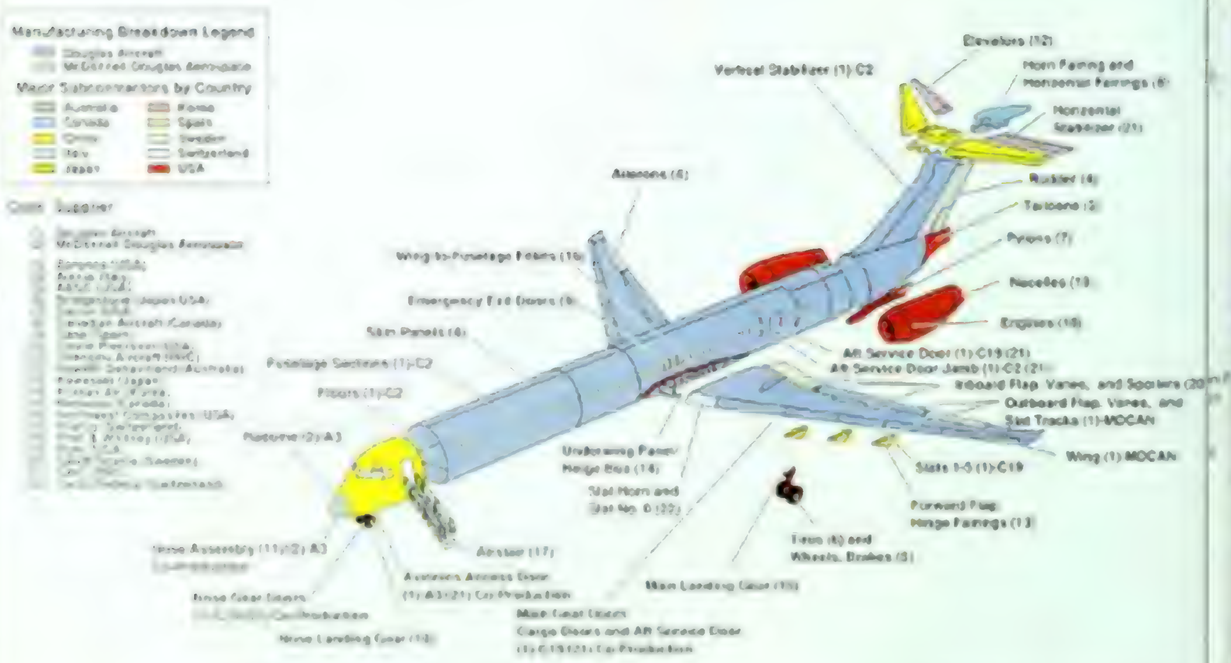
RIGHT: Viewed from Building 13, the original assembly hall for both the DC-9 and the MD-80 series. Prior to 1990 the fuselage was built panel by panel, the MD-90 panels being manufactured by Aviones de Baja before shipping to the USA for assembly at Long Beach. In 1990 the method of construction changed to the 'barrel' method and now the panels are assembled into circular sections at the MDC Salt Lake City, Utah facility and shipped to Long Beach for mating in the huge Building 80. *MDC*

BELOW: Recent Being prepared for delivery to airlines around the globe, factory new MD-87 twin jets and MD-11 trijet aircraft are seen parked on the flight ramp at Long Beach during April 1988. The four there are MD-88s in Delta livery, visible two more await their paint to be applied. Each new airliner is test flown as required by both MDC and airline pilots before being accepted for delivery. *MDC*

BELOW: Complex of MD-80 series components manufacturers. *MDC*

MD-80

Component Manufacturers



Following six years of negotiations between the parties, the agreement cycled initially for the purchase of 26 MD-80s (seven new-build, with 23 to be assembled in Shanghai). It was the first ever such agreement between a US aircraft manufacturer and the People's Republic of China. The pact also established a joint task force between the Long Beach Division of MDC and the Chinese aviation industry to carry out engineering and production studies aimed at cooperative development of new commercial transports in the future. It also provided for countertrading allowing for export manufacturing trade and foreign industrial investments for China.

The first of 26 MD-80s was fully assembled at Long Beach and delivered to CAAC in December 1983. This was [illegible] MD-82, but it was not taken up and was instead delivered to CAAC on 15 December 1983 as the 151st example (registered B-2141). Named *Dong Fang Hong* (Red Is the East), it was the first of 10 MD-82s delivered to CAAC in 1983 and 1984, and was followed by two more in December 1985.

The first sub-assemblies of aircraft components were shipped from Long Beach for CAAC in January 1986 and the first Shanghai-built aircraft rolled out of the Shanghai Aviation Industrial Corporation factory during early 1987. In the MD-80 production listing, f/n 1292/3 s/n 49501 to f/n 1746/7 s/n 49424 are all Shanghai-built MD-83s, with the latter one being completed in January 1995. The production rate has shown a significant increase during the first half of 1989. But political turmoil in China and late deliveries of components from Long Beach slowed down the programme.

During April 1990, MDC and SAIC concluded an agreement to extend the co-production programme with an additional 30 airliners. The new order took the Shanghai assembly line into 1994, bringing total commitments to 90, of which 76 were built in China. As Chinese orders for twin-jet transports were finally contested, with CAAC eventually ordering Boeing 737-700s and 737-800s, MDC at Long Beach had agreed in 1979 to have SAIC build undercarriage doors, access and service doors, door frames and even wing components. In July 1986, Long Beach awarded additional contracts covering the manufacture of complete MD-80 nose sections by the Chengdu Aircraft Corporation and of MD-80 horizontal stabilisers by SAIC, with Chinese-built components to be shipped to Long Beach.

The MD-80s in China are today operated by Shanghai-based China Eastern Airlines, which commenced service with the twin-jets in December 1985, and by China Northern Airlines, based in Shenyang, which began flying them in December 1985. Today China Eastern operates a large fleet which includes the MD-82, the DC-10 derived MD-11 and a successor to the MD-80, the MD-90-30. China Northern has also added the MD-90-30 to its large fleet.

ABOVE: The construction at Long Beach in January 1987 with MD-88 models being prepared for airline delivery to Delta Airlines. Commercial Mixers cited Area Ruled. A decade later all but one of these operators would still be flying this popular airliner. The two Delta aircraft are MD-88s – N908DL, c/n 49536 (c/n 1108, handed over 9 January 1987 and N906DL, c/n 49543 (c/n 1167, which completed on 13 February 1987. In June 1988 N906DL was converted to MD-88 configuration.

ABOVE LEFT: Photo taken inside the MDC nose jet paint booth in Building 87 at Long Beach. This unique building looks like a square with a triangle cut-out when viewed from above. Here the tail cone of a Delta Airlines MD-88 is receiving attention. MDC

The twin jet airliners built in Shanghai are MD-82 models powered by two JT8D-217A engines rated at 20,000lb (88.8kN) take-off thrust. They seat 145 passengers in a mixed-class interior arrangement and have non-stop range of up to 2,360 statute miles (3,795km). Five MD-83s, incorporating auxiliary fuel tanks for extended range service, were also built as part of the programme.

The training of Chinese production managers and skilled workers for their jobs commenced in the summer of 1985. Large-scale exchange of personnel between China and the USA took place to accomplish this unique task. Furthermore, Long Beach personnel were assigned to work at China to provide a smooth manufacturing liaison.

TRUNKLINER

On 30 June 1992 an order was sealed for 20 MD-80s and 30 MD-90Ts for China Aero-Technology Import & Export Corporation (CATIC) plus options for a further 140 MD-90s. On 25 June (received final government approval from Beijing. The agreement exceeded $4 billion in value and provided for a growing demand for Chinese assembled airliners in that nation's trunk and regional airline routes, but was sadly ill-fated.

The first three MD-90s delivered in 1995 were normal airliners, the remainder delivered in 1996 were quoted as MD-90Ts plus all the MD-90s will likewise be MD-90Ts. The 'T' stands for 'Trunkliner' the main difference being that these airliners have a new main landing gear with four wheels on each side, instead of the normal two wheel arrangement. Assembly is with the Shanghai Aviation Industrial Corporation.

The first dual tandem aisle/corridor airliner is quoted as being SAIC No 35 used as a development aircraft. First production airliner MD-11CT was quoted as SAIC No 48. MD-82 c/n 1827/1934 c/n 53432 was the first to be marketed in the USA.

MD" after being ferried to Long Beach in June 1992. day five Shanghai built MD-82s are in service with TWA. our being N396TW c/n 1827/1934 c/n 53432, N2402W c/n 46/1981 c/n 53438, N2403W c/n 1899/1981 c/n 53439, N2404V c/n 1853/1982 c/n 53440, and N2405T c/n 1930/1983 c/n 53441. ll were completed in China during 1992.

Long Beach forecast that MD-80/MD-90 Trunkliner production would commence in 1998 and continue past 2000, with production rates ranging from four to 10 airliners per year. The movements called for a gradual increase in the level of component fabrication and sub-assembly work in China's factories.

However, China's airlines have been buying Boeing 737s other than MD-80s and MD-90s. During a state visit to the USA, Chinese president Jiang Zemin [illegible] $3 billion order for 30 new Boeings, [illegible]

Originally, 150 MD-90 airliners were to be built in China but the programme proved to be a monumental task from the outset. At Long Beach, 70 MD-90s had already been built in Shanghai together with another 50 built at Long Beach.

Below: Taken in early 1991, this photo shows MD-80s on the final assembly line at Long Beach. The first two are MD-82 N9029B for Pacific Southwest, completed in October 1981, and SAS JA8143 DC-9-82 (MD-82) for Aero Mexico, completed in October 1986. The airliners were delivered to the respective airlines in January 1981 and

4 TECHNICAL SPECIFICATION

DC-9 ENGINE/TO WEIGHT PROGRESSION

Type	*Powerplants*	*Thrust Rating*	*Max gross TO Wright*	*Notes*
Series: D-9-10				
DC-9-11	JT8D-5	12,000lb (53.4kN)	77,000lb (34,926kg)	Fuselage length 104ft 5in (31.85m); wing span 89ft 5in (27.28m)
DC-9-12	JT8D-1 or -7	14,000lb (62.2kN)	85,700lb (38,873kg)	
DC-9-14	JT8D-5 or JT8D1	12,000lb (53.4kN) 14,000lb (62.2kN)	76,300lb (34,609kg)	
DC-9-15	JT8D-1 or -7	14,000lb (62.2kN)	90,700lb (41,141kg)	
DC-9-15F (DC-9-15RC)	JT8D-7	14,000lb (62.2kN)	90,700lb (41,141kg)	RC: Rapid Change, palletized removable seats
DC-9-15F	JT8D-1	14,000lb (62.2kN)	90,700lb (41,141kg)	MC: Multiple change, folding removable seats
Series: DC-9-20				
DC-9-21	JT8D-9	14,500lb (64.4kN)	100,000lb (45,359kg)	High performance for high density altitude operations fuselage 104ft 5in (31.85m), wing span 93ft 5in (28.5m)
	or JT8D-15	15,000lb (66.6kN)		
Series: DC-9-30				
DC-9-31	JT8D-1 or JT8D-7	14,000lb (62.2kN)	98,000lb (44,452kg)	Fuselage stretched to 119ft 5in (36.4m)
DC-9-32	JT8D-7	14,000lb (62.2kN)	108,000lb (48,988kg)	
	JT8D-9	14,500lb (64.4kN)		
	JT8D-11	15,000lb (66.6kN)		
	JT8D-15	15,500lb (66.6kN)		
DC-9-32F (AF)	JT8D-9 or JT8D-11	14,500lb (64.4kN) or	108,000lb (48,988kg)	All freighter configuration
DC-9-32CF	JT8D-9 or JT8D-11	15,000lb (66.6kN)	108,000lb (48,988kg)	Convertable freighter also offered as rapid change
DC-9-32 (C-9A)	JT8D-9	14,500lb (64.4k)		'Nightingale' military aeromedical version for USAF
DC-9-32	JT8D-9	14,500lb (64.4k)		'Skytrain II' logistics support for USN and US MC
DC-9-32 (VC-9C)	JT8D-9	14,500lb (64.4k)		Only three delivered to USAF See msn 47668, 47670, 47671
DC-9-33F	JT8D-15	15,000lb (66.6kN)	114,000lb (51,709kg)	
DC-9-33CF	JT8D-9 or -11		114,000lb (51,709kg)	Convertable freighter also offered as rapid change
DC-9-34	JT8D-17	16,000lb (71.1kN)	121,000lb (54,884kg)	Extended range
DC-9-34CF	JT8D-17	16,000lb (71.1kN)	121,000lb (54,884kg)	
Series: DC-9-40				
DC-9-41	JT8D-11, or -15			Fuselage stretched to 125ft 7in (38.3m) high capacity, shorter range
Series DC-9-50				
DC-9-51	JT8D-17	16,000lb (71.1kN)	121,000lb (54,884kg)	Fuselage stretched to 133ft 7in (40.27m)
Series: DC-9-80 (MD-80)				
DR-9-81 (MD-81)	JT8D-209	18,500lb (82.2kN)	140,000lb (63,503kg)	Fuselage 147ft 10in (44.8m); wing span 107ft 10in (32.6m)

Type	*Powerplants Offered*	*Thrust Rating*	*Max gross TO Weight*	*Notes*
DC-9-81 (MD-81)	JT8D-209	20,000lb (88.8kN)		
	217, 217A, 217C, 219	21,000lb (93.3kN)		
DC-9-82 (MD-82)	JT8D-217, -217A	20,000lb (88.8kN)		High performance for high density altitude operations, increased payload, range
DC-9-83 (MD-83)	JT8D-219	21,000lb (93.3kN)	160,000lb (72,574kg)	Increased range, reduced fuel consumption
DC-9-87 (MD-87)	JT8D-217C	20,000lb (88.8kN)	125,000lb (56,699kg)	Fuselage shortened to 119ft 1in (36.3m), taller tail, no rear doors, also certificated at higher MGTOWs
	JT8D-219	21,000lb (93.3kN)		
DC-9-88 (MD-88)	JT8D-219	20,000lb (88.8kN)	149,500lb (67,812kg)	Improved cockpits with EFIS, flight management systems; interior improvements
MD-90-30 IAE	V2525-D5	25,000lb (111kN)	156,000lb (70,760kg)	28,000lb (124.4kN) thrust on demand

MD-80 SERIES VITAL STATISTICS

Overall length	147ft 11in (45.1m); **MD-87** 130.5ft (39.8m)
Width	107ft 10in (32.89m)
Height:	29ft 7in (9.02m)
Wing span	107ft 10in (32.87m)
Flight Crew	Two
Passengers	172 max; **MD-87** 139 max;
Range	1,580 to 2,750 statute miles (2,540 to 4,420km), depending on model
Max take-off weight	
MD-81	140,000lb (63,503kg)
MD-82 and basic MD-88	149,500lb (67,813kg)
MD-83 and MD-88	160,000lb (72,576kg)
MD-87	140,000lb (63,503kg) — option 149,500lb (67,812kg)
Max cruise speed	575mph (925km/h)

MD-90 VITAL STATISTICS

Overall length	152ft 7in (46.5m)
Wing span	107ft 10in (32.87m)
Cargo	1,300cu ft (36.8cu m)
Cruising speed	500mph (812km/h)
Passengers	152 (in mixed-class configuration)
Flight Crew	Two
Basic MD-90-30	
Max take-off weight	156,000lb (70,760kg)
Max take-off weight option	160,500lb (72,800kg)
Range	2,400 statute miles
Higher Gross Weight MD-90-30	
Max take-off weight	168,000lb (76,203kg)
Range	2,510 statute miles (4,040km)
Range option	2,765 statute miles (4,450km) with auxiliary tank
Take-off thrust	25,000lb-28,000lb option (11,340kg-12,700kg option)
Min runway length	5,000ft (1,524m) on 550 statute-mile (885km) operation with fab pavement load
Min runway length	7,450ft (2,270m) at max take-off weight

POWER FOR THE MD SERIES

Formed at East Hartford, Connecticut, USA, Pratt & Whitney Aircraft was formed in 1925. Today, as part of the huge United Technologies Corporation, the Pratt & Whitney Group is the world's largest producer of gas turbine engines. Including Pratt & Whitney Canada, it had by 1989 delivered some 70,000 aircraft gas turbines – including more than 35,000 airliner jet engines.

It can be revealed that the development of a re-fanned JT8D was actually sponsored by the US National Aeronautics & Space Administration, NASA. By re-designing the high-pressure compressor, HP turbine spool, and combustion section of the proven JT8D-9 engine with a new six-stage low-pressure compressor and LP turbine, and adding a new bypass duct, Pratt & Whitney was able to develop the JT8D-200 series. Compared with earlier JT8D versions, the new series offered increased thrust as well as substantial reductions in noise and specific fuel consumption. Engine weight and diameter were increased respectively from 5,250 to 5,896lb (1,063 to 1,191kg) and from 42.5 to 43.6in (1.08 to 1.14m). This still enabled re-fanned JT8Ds to be installed in nacelles not significantly larger than those of earlier JT8D versions.

The earlier uncowled JT8D-7 was the youngest in Long Beach production line-facing, along with the JT8D-9A, powered the Douglas DC-9-30, -40, -50 and the military C-9A, C-9B and VC-9C transports.

A pair of JT8D-109 re-fanned prototypes were also fitted to a DC-9-32 (c/n [illegible]; Fig 2-41) under a NASA contract, and the combination first flew on 9 January 1983. After being re-engined with the JT8D-11s operated for installation on the DC-9-20, -30 and -40, the airliner was delivered as DC-9-81 (YU-AJK) to Inex Adria Aviopromet on 6 March 1983. On 11 September 1976 it was destroyed in a mid-air collision at Trebinje 38 (1) AWZT, near Vrsbve village, north-east of Zagreb, Yugoslavia.

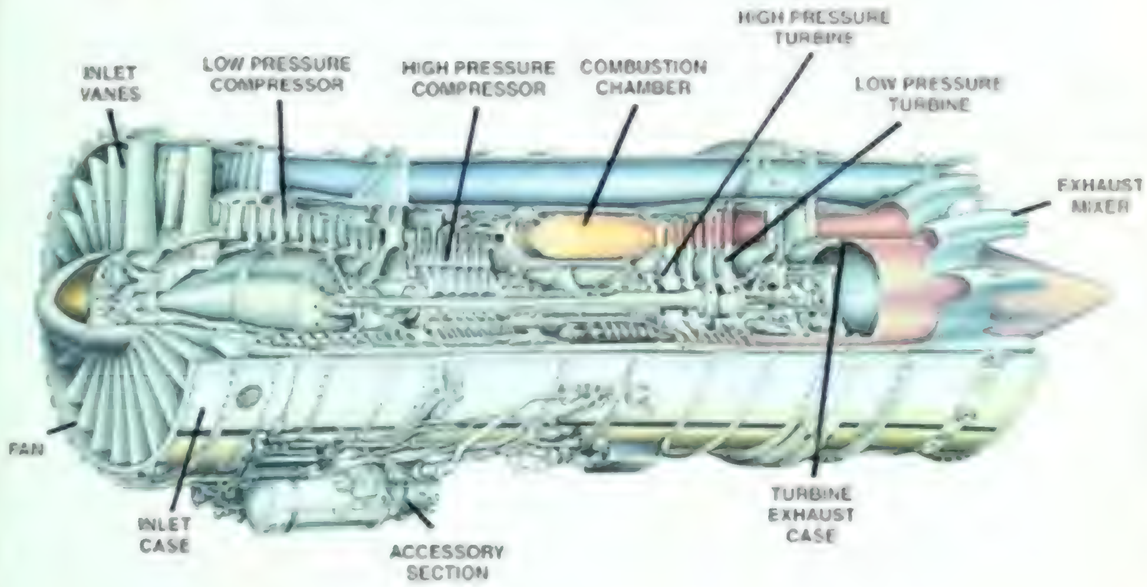
Even prior to the pressure from the licensee prospective customers, Douglas, being able to obtain a production commitment from Long Beach, the stretched and re-engined twin-jet was the subject of several proposed new configurations. Launching Boeing DC-9 Super 80 – as the General Aviation Service DC-9 [illegible]

Right: One of the most powerful airliners in the Pratt & Whitney JT8D series is the re-fanned JT8D-209 which powered the early MD-80 [illegible]. It began its passenger-to-NASA Quiet Engine programme which has combined aerospace [illegible]. The JT8D-209 engine entered commercial service on the Swissair MD-81 which first flew on 1 October 1986. [illegible]

Below, Inset: Running overtime on the Long Beach ramp is DC-9-82 (c/n 49[illegible]) first registered N9[illegible] — the very first MD-88. It is powered by the Stage 3 quiet-fitted and re-rated JT8D-219 turbofan. This photo was taken prior to its first flight and its registration has yet been painted on the engine nacelles. Until it was upgraded to the MD-88 status and gold livery and re-named MD-88, it was referred to as "209" (denoting its engine model designation) in the company's literature. It is currently in storage at Grayson County Airport, Sherman, Texas.

Below: Engineers at the Pratt & Whitney plant located at Hartford, Connecticut, prepare another JT8D-200 series turbofan for delivery. No exclusive engine for the MD-90 is yet on offer, the JT8D-200 covers the 18,500-22,000lb (82.3kN-98kN) thrust range. The JT8D-200 powered MD-80 airliners meet current environmental restrictions for noise and emissions. Since commencing in-service service in 1980, over 2,000 engines have been produced in five different models forging over 30 million hours of operation.

JT8D-200 SERIES TURBOFAN



and DC-9-SC fitted with a new supercritical wing etc. At this time the company even considered the joint development with Dassault-Breguet of the ASMR (Advanced Short to Medium Range) derivative of the French designed Mercure. Research soon proved that a new version of the ubiquitous DC-9 would prove less costly to develop and manufacture than the French ASMR and, as it would reduce training, spares and facility requirements, was clearly far more attractive to the many existing DC-9 operators.

THE JT8D-200 SERIES

The reduced noise derivative of the JT8D combines the HP compressor, HP turbine speed and combustion section of the JT8D-9 with advanced LP technology. It offers increased thrust with reduced noise and specific fuel consumption. The fan has increased diameter. The new six-stage LP compressor, powered with the fan, offers increased pressure ratio. The LP turbine has 20 percent greater annular area and achieves a higher efficiency. Surrounding the engine is a new bypass duct. The exhaust system includes a 12 lobe mixer. Certification of the JT8D-209 was awarded by the Federal Aviation Administration (FAA) in June 1979.

Current models of the 200 series include the following:

JT8D-209 18,000lb st (82.2kN) rating to 25°C.
19,250lb st (85.6kN) in case of loss of thrust on any other engine.
First service October 1980 on the MD-81.

JT8D-217 20,000lb st (88.9kN).
20,850lb st (92.75kN) after loss of thrust on any other engine.

JT8D-217A Take off thrust to 28.9° up to 5,000ft (1,525m).

JT8D-217C Incorporates JT8D-219 performance improvements.

JT8D-219 Rated at 21,000lb st (93.4kN) with a reserve power of 21,700lb st (96.5kN).

STOL

In 1978 an attempt at meeting short take off and landing requirements (STOL) in Japan had been made with the DC-9 Super 80SF, combining the advanced wing and engines of the basic Super 80 with the fuselage of the DC-9-40. Most of the development costs would have been covered under the Super 80 programme. However, it was decided that the progressive application of the more powerful JT8D-217 engines in the versions already projected would provide similar airfield performance and so the Super 80SF was not proceeded with.

Prior to the first flight of the DC-9-80 in December 1979 Long Beach had turned its attention to the next major development — known as the DC-9-60 — to take advantage of the more advanced versions of the successful Pratt & Whitney JT8D engine. An early example of this engine, the JT8D-109, was flight tested on DC-9-32 N3436 commencing on 9 January 1975. In close cooperation with Pratt & Whitney, a number of advanced studies explored a number of other DC-9 derivatives, ranging from the odd ball designated DC-9-17 powered by JT8D-17R turbofans incorporating automatic power reserve, to re fanned versions such as the DC-9-50 (Re fan Stretched) DC-9-50RSS (Re fan, Super Stretch) and the later and similar DC-9-53.

All these had a bigger wing, more power and a stretched fuselage which would have enabled the new aircraft to carry more passengers than the proposed DC-9-50 over the same distance as the extended range DC-9-40. Another innovative proposal already mentioned was the DC-9-SC, which featured a all new super-critical wing. Actively under consideration was the DC-9-QSF (Quiet Short Field) offered to the Japanese airlines who were seeking a replacement for their NAMC YS-11 turboprop airliner.

This was basically a DC-9-40 with a new wing which was enlarged by the insertion of a 10ft (3.04m) centre section, and re fanned JT8D-209 engines, rated at 18,000lb st (80kN). With a gross weight of 114,000lb (51,710kg) the DC-9 QSF was intended to carry a passenger load of 120, all the year round, from 4,000ft (1,200m) runways.

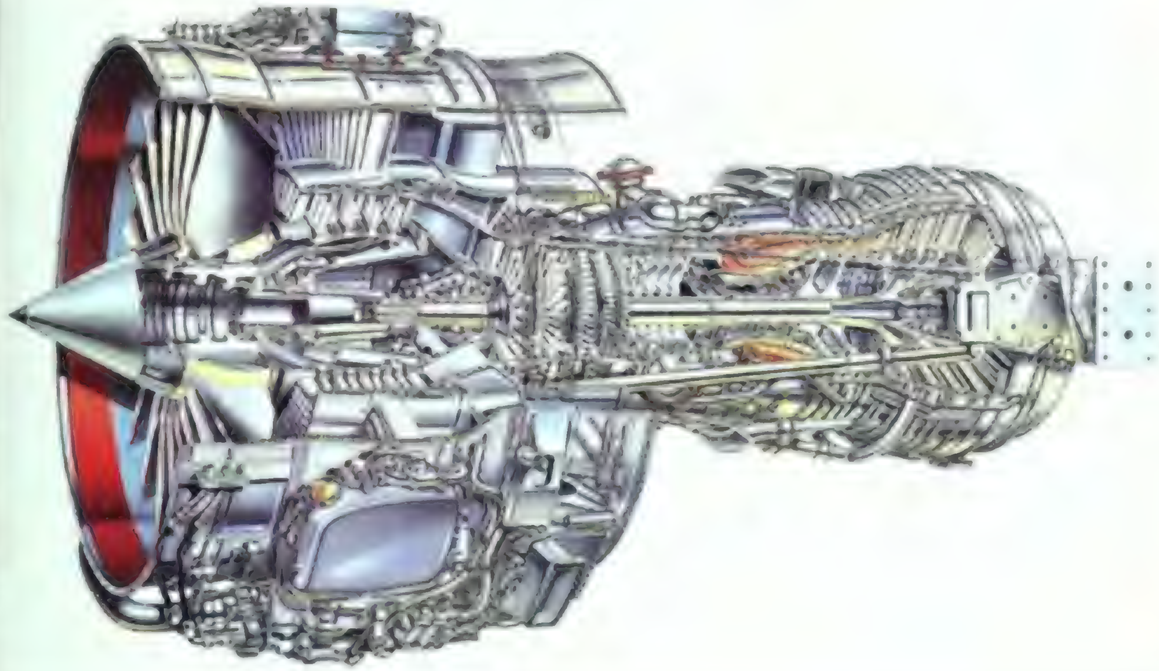
Similar claims to meet the requirements of the Japanese airlines were made for the proposed DC-9-32, first announced in 1977. This up-rated development of the DC-9-32, the 'hot rod' airliner operated by the Scandinavian Airlines System (SAS), which featured the installation of the more powerful JT8D-15 or -17 turbofans, additional wing spoilers and an improved braking system. Both these designs were eventually shelved in favour of the more advanced concepts, this clearly and almost exclusively pointed the way to the new re fanned JT8D-200 series of turbofans, which was given the go-ahead in March 1977. Because of the high costs involved uprated engines were rejected — plus on grounds of noise. New engines were also costly. The all new super critical wing was also discarded as being too expensive.

INTERNATIONAL AERO ENGINES

With all the speculation as to whether there would ever be a merger between two of the big three aerospace engine manufacturers, it must be recalled that collaboration between three took place some decades ago. Possibly the most successful current collaboration commenced way back in 1983 with the formation of International Aero Engines (IAE) in which both Rolls-Royce and Pratt & Whitney have a stake and are in fact lead partners.

The venture's success is even more remarkable when one considers that originally there were five collaborators, the others being Motoren-Und Turbinen (MTU) Daimler Benz of Germany, FiatAvio from Italy, and a group of Japanese companies, Mitsubishi, Kawasaki and Ishikawajima Harima, operating under the title of the Japanese Aero Engines Corporation (JAEC). In 1986 FiatAvio sold its share, so the unique make-up of IAE is Pratt & Whitney and Rolls-Royce 32.5 percent, JAEC 23 percent and MTU Daimler Benz 12 percent.

The consortium set up home in an old schoolhouse in East Hartford, Connecticut. Today its American base is inside the Pratt & Whitney complex just a few hundred metres from the



...ers International Aero Engines (IAE) — a consortium with Rolls-Royce and Pratt & Whitney as the leading partners — build the V2500 D5 for the MD-90.

...iginal location. Some business pundits would inevitably agree that bringing together international partners to work in a highly complex collaboration is just about the most risky option available. But in fact that is exactly how the new V2500 aero engine has been.

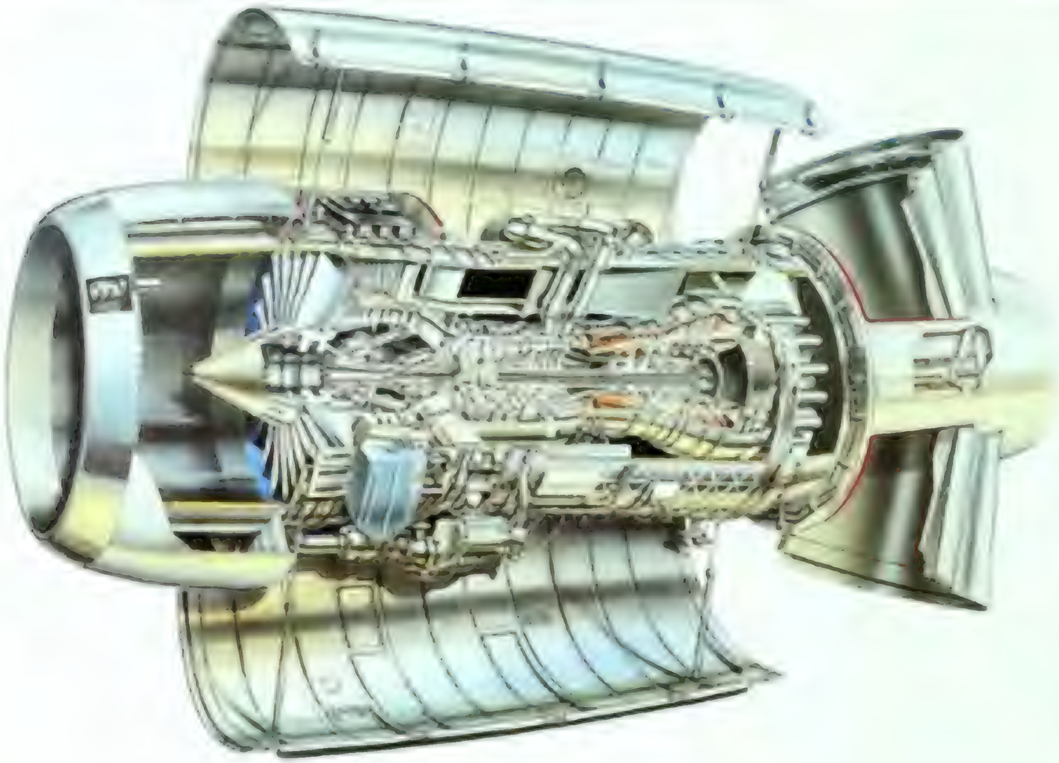
In 1989 the first V2500 engine from IAE entered service and by August 1997 this engine series had just passed five million flying hours. Since 1989 a family of engines under the V2500 designation has been developed. The MDC MD-90 twin jet airliner utilises two of eight thrust ratings, the V2525-D5 and V-2528-D5. The order book for the V2500 stood at over 2,000 engines by August 1997, with a total value of over $18billion. The customer base is made up of over 70 airlines and leasing companies with the MD-90 having customers in Europe, Asia, the Middle East and North America.

Though IAE does not have its own engine shops, there are eight locations around the world for major work plus nearly 300 representatives, the after-sales service support benefitting from the existing Rolls-Royce and Pratt & Whitney networks.

To find a name, IAE combined the Roman 'V' representing the five original partners, and the number 2500, an abbreviation of the engine's maximum thrust of 25,000lb (111kN) — the equivalent of 12.5 tons of power. Each of the partner companies involved was given responsibility for developing and delivering one of the five engine sections or modules. IAEC controlled the fan and low pressure compressor, Rolls-Royce took responsibility for the high pressure compressor, Pratt & Whitney had the task of producing the combustor and high pressure turbine, while MTU the low pressure turbine and FiatAvio the gearbox.

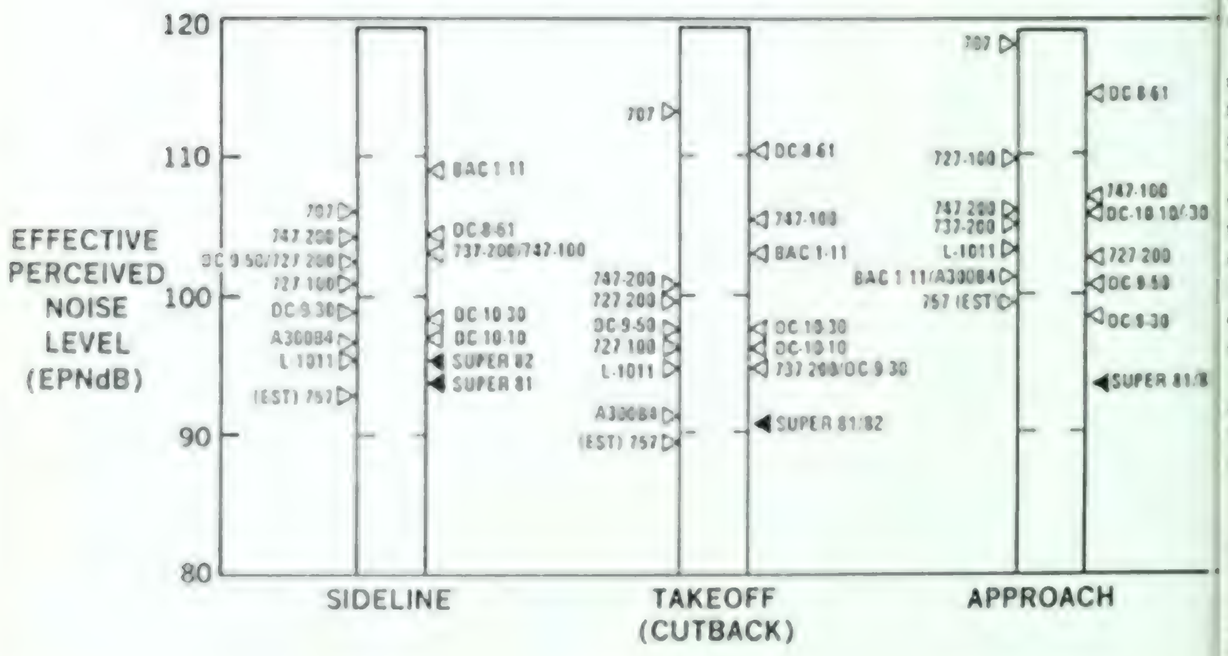
The V2500 engines are manufactured on both sides of the Atlantic. The engines destined for Airbus Industries in France are assembled by Rolls Royce in Derby, while those for MD-90 are shipped to Long Beach by Pratt & Whitney from East Hartford.

One of the most noticeable features of a jet engine is its fan blades, and in the case of the V2500, they provide a good example of the advanced but proven technology contributed by the IAE partners. The V2500 uses unique hollow blades designed and developed by Rolls-Royce. These are made from two sheets of titanium which are heated to a state where they can be moulded. While they are being twisted into their final aerodynamic shape the two halves are bonded together, then gas is blown between the sheets, producing a metal honeycomb centre. The resulting semi-hollow blade is light yet extremely strong and has the ability to bend on impact: a vital asset which dramatically reduces the potential damage from objects such as runway debris and birds.



NOISE-LEVEL COMPARISONS

FAR PART 36, STAGE 3 CONDITIONS



Pratt & Whitney's 'floatwall' combustor is another piece of V2500 technology in which, as its name implies, the inner liner walls, the outer skin separated from the metal closest to the centre of the burner by a gap which allows it to remain cool and less susceptible to the type of cracking experienced by conventional designs.

The engine's low noise signature is good news for both passengers and airport communities. The V2500-powered MD-90, for instance, is up to 25 decibels below today's statutory limits and well inside any proposed noise limitations. This outstanding 'green' advantage comes from detailed attention to design. The V2500's full length cowl acts as a barrier to side noise. A positive benefit is also gained by mixing cold air flow from the bypass with the hot jetstream. Furthermore the profile of the wide chord fan blades also contributes to noise reduction, just as it protects the engine from foreign object damage (FOD).

The V2500 also provides airlines with yet another important technical benefit — commonality. Apart from the way the engine is mounted on the airliner, all versions of the V2500 are mechanically identical. Any change in thrust is simply commanded by computer. With over 70 airline and leasing company customers around the world, plus orders to power almost 1,000 aircraft and a $12billion order book, the V2500 continues to prove that conventions can be successfully broken down in the world of international business.

BMW ROLLS-ROYCE BR715

BMW Rolls-Royce reached another milestone on 28 April 1997 with the successful first run of the BR715, the powerplant for the new MD-95 airliner, at the company's development and assembly centre located at Dahlewitz, near Berlin, Germany. Designed for 22,000lb (98kN) thrust the engine has been certificated at 21,000lb (93kN) thrust and within 24 hours of its first run, it achieved 23,745lb (110kN) thrust, albeit on a cold morning.

The BR715 turbofan has been developed for 90-130 seater regional aircraft and has been selected as the sole powerplant for the MD-95-30 twin jet airliner. First flight was scheduled from Long Beach for the second quarter of 1998 followed by Federal Aviation Administration (FAA) certification and entry into service with AirTran who as ValuJet was the launch customer. (ValuJet was re-named AirTran in August 1997.) There is great confidence that Boeing with their take-over at MDC Long Beach will support the MD-95 programme as it has no competition, while the Long Beach designers are looking at smaller versions of the airliner.

Second in the BMW Rolls-Royce BR700 family of clean, quiet, fuel and cost efficient engines for the next century, the BR715 engine family was launched in March 1991 with a thrust range of 14,000-23,000lb (62-102kN). It is based on a single core. The fan is [illegible] for low noise. The engine has a 58in (1.47m) fan [illegible] and is based on the BR700 core with the high pressure [illegible] for mass flow and efficiency and the high [illegible] enhanced for increased durability using single crystal cooled blade material.

The innovative design of the BR715 high by-pass ratio turbofan engine includes the largest ever 'fixed' titanium blade and disk used in a civil engine, an intermediate gear which is the largest single piece of titanium casting in a civil engine, and the very first incorporation of design aspects from the Rolls-Royce advanced low pressure system research into a production engine programme.

Early tests on the first development BR715 engine will include a performance assessment with fan and low pressure turbine strain gauging. The engine will undergo cross-wind starting and thrust reverse cycling at the Rolls Royce facility located at Hucknall in the United Kingdom. The length of the BR715 engine is 190in (4.79m), fan diameter 58in (1.47m) and weight including the nacelle is 6,135lb (2,723kg).

Early in 1998, BMW Rolls Royce delivered the first two BR715s to Boeing's Douglas Products Division at Long Beach ready for the first flight of the MD-95, then predicted in the second quarter of the year.

ULTRA-HIGH-BYPASS ENGINES

With a look into the future, the MDC design and engineering team trained its conceptual thoughts for further development of its twin-jet airliner series during the mid 1980s. Among the resulting designs were more than one known as MD-90, before that designation was eventually applied to a production series airliner.

The 'drawing board' computer activities of the Long Beach team produced what was tentatively referred to as the MD-X during 1985. It was designed firmly around the new concept of Ultra-High-Bypass (UHB) engines driving highly contoured, counter-rotating, multi-blade fans. Developing the UHB engine, which was also referred to as Unducted Fan (UDF), for the basis of a new range of airliner derivatives was undertaken in cooperation with Aeritalia, Saab-Scania and Snecma. Applications International Corporation of San Diego.

The project crystallised into two new variants of the successful Long Beach built twin-jet airliner, the 114-seat MD-91X and the 163-seat MD-92X, which were being offered to potential customer airlines from early 1988. Whereas propfan engines could be substituted for the rear mounted Pratt & Whitney JT8D-217 turbo fans on its MD-80 [illegible], neither Airbus Industries or Boeing could do so with their A320 [illegible] or Boeing 737/757/767/777 series due to their [illegible] engines.

In the four years from 1985, MDC [illegible] engined as the power plants for new short to medium range airliners with propfan power claimed to yield [illegible] percent fuel savings over state of the art [illegible] and 30 percent lower [illegible] with the MD-80.

Flight testing from Edwards Air Force Base started on 15

Above Left: BMW Rolls-Royce is powering the powerplant for the new MD-95 airliner — the BR715. (BMW Rolls-Royce)

Left: Engine noise levels are very important factors in today's competitive market place. This MDC prepared chart shows the relative positions of the competition when the MD-81 and MD-82 entered the market. (MDC)

May 1987, using General Electric GE36 Unducted Fan engines on the port side of the MD-80 prototype N900DC (c/n 909 s/n 49056). This was used to demonstrate the potential of a proposed re-engined MD-88 and propfan powered MD-90 series. Initially the GE engines were tested with two 8-blade fans of 126 (3.84m) diameter. On 15 August flight test trials with an improved engine with a 10in blade fan in front and an 8-blade fan at the rear commenced. Tests with a Pratt & Whitney/Allison 578-DX powerplant commenced in March 1989, the first flight taking place at Edwards on 13 April 1989.

The UHB demonstrator was modified to test the 20,000lb (88.8kN) thrust 578-DX propfan engine jointly developed by Allison and Pratt & Whitney. It drove two sets of 6-bladed counter-rotating propfans and was again mounted on the port nacelle. However, by this time, MDC was about to conclude that the development of propfan powered airliners was not yet justified.

MDC also entered a propfan powered MD-87 in the US Navy's Long Range ASW Capable Aircraft (LRAACA) competition, but the Lockheed P-7, a development of the P-3 Orion, was given preference.

Yet a further MDC project was an all new propfan follower to the MD-80, known as the MD-94X. In addition to the UHB engine, this 160-180 passenger airliner featured laminar and turbulent boundary layer control, very high aspect ratio super critical wings, flight-critical active stability augmentation digital control systems, fly-by-wire and fly-by-light technologies and all electric secondary power systems. A UHB retrofit programme for the MD-80 was also on the drawing board, said to achieve an up to 40 percent reduction in fuel consumption.

The MDC design and engineering team had not been idle, the company was also able to present to the airlines another alternative, the MD-90X series powered by the successfully developed International Aero Engine (IAE) V2500 advanced high bypass engine. The series initially comprised the standard stretched MD-91Y with accommodation for 114 passengers, and the larger 142 seat MD-93Y. Then, in response to airline interest a still larger third variant was added to the programme. This was the MD-95Y fitted out in a two class configuration with up to 180 seats.

The new designs became finely tuned towards optimum customer requirements, and it soon became evident that the immediate future lay with the new V2500, a fully developed and certified engine. This offered a considerable advantage in a highly competitive business.

Missions must be made at the proposed MD-90-30ER (Extended Range) military C/D Skytrain III transport for the US Navy, who had boasted about the great efficiency of their fleet of Skytrain III transports, mainly DC-9-40 variants. Powered by two fuel efficient V2534-D5 engines each producing 34,000lb (151.3kN) of thrust MDC believe the result is a highly reliable transport capable into the 21st century as the new commercial aviation leader.

The interior of the C-9D is configured as a COMBI (Combined Cargo and/or Passenger) aircraft. In the combi mission there are up to four cargo pallet positions forward with up to 99 passenger seats, aft galleys, lavatories, overhead bag racks and stowage cabinets. In the all passenger mode the C-9D can accommodate up to 124 passengers with the overhead forward galleys and lavatories.

Currently, the proposed C-9D is being studied for incorporating a main instrument panel with six active 8 in Liquid Crystal Displays (LCD) panels. In addition to the baseline MD-90 avionics options will include Global Position System (GPS) Satellite (SATCOM), and dual UHF communications. Wing span is 107ft 3in (32.87m), length 153ft 7in (46.84m).

During the early 1990s, in order to provide a smoother transition to the new MD-90, MDC was considering an improved version incorporating some of the best elements of the MD-80 series design with a new engine for the existing MD-80 airframe. In addition to the engine (which existed only on paper) the MD-80 Advanced was to offer a new flight deck instrumentation package and a completely new passenger compartment design. All would be available as retrofit for existing MD-80s and was forecast to be in service by July 1993. Development of the MD-80 Advanced was dependant on whether Pratt & Whitney launched the JT8D-290, an improved version of the successful JT8D-217C, with a lower noise signature and a 5 percent target reduction in gaseous emissions.

The MD-80 Advanced was to incorporate the advanced flight deck from the MD-88, including a choice of reference systems with an inertial reference system as standard fitting and optional attitude heading equipment. It was to be equipped with an electronic flight instrument system, an optional second flight management system computer, light emitting diode dot matrix electronic engine and system displays. A Honeywell windshear computer and provision for an optional traffic-alert and collision avoidance system were also to be included. A new interior would have a 12 percent increase in overhead baggage space and stowage compartment lights that come on when the door opens, as well as a new video system featuring drop-down liquid crystal display monitors above.

WHEN IS A DC-9 AN MD-80?

The rather perplexed question 'when is a Douglas DC-9 a McDonnell Douglas MD-80?' is often asked. This arises most especially if an operator decides to decorate its airliner short with an anomaly which confuses the issue. A few examples are the inscription 'DC-9 Super 80' on the engines of the MD-81 PH-MBY, c/n 1093 s/n 48048, Austral's MD-81 which had 'DC-9' inscribed on top of the fuselage, this being N807AU c/n 948 s/n 48024, and the PSA MD-81 N982PS, c/n 974 s/n 49035, which had 'DC-9' on the engine nacelles.

As the MD-80 was not in effect a new aircraft, it continued to be operated under an amendment to the original DC-9 Type Certificate issued in the USA by the Federal Aviation Agency (FAA) which certificates the airworthiness of a particular type. This data sheet prescribes conditions and limitations under which the product for which the Type Certificate was issued meets the airworthiness requirement of the Civil Air Regulations.

A Type Certificate is issued with the aircraft model designa-

...wing: The image of a new N...
...livered Alaska Airlines MD-83 is
...flected on a wet flight ramp at
...ing Boeing on 23 March 1992
...ore the airline took delivery of
...D-83 N964AS (in 1-4000).
...D-80 series variants. The Seattle
...ased airline currently operates a
...et of nearly 30 of the MD-83
...ery successful aircraft serving 40
...destinations. The photo shows a DS
...ssembled assembly, and shows clo
...ew of the nose of the aircraft —
...1.07ft 10in (32.69m) long and
...ft 2in (9.19m) high.
...P Collection

...ckground: The UHB demonstrator test
...N960DC, was modified to flight test
...the 20,000lb (88.8kN) thrust 578-DX
...propfan engine, jointly developed
...by Pratt & Whitney and Allison. It
...had two sets of six-bladed counter-
...rotating propfans. First flight was
...made from Edwards AFB on
...13 April 1989. The UHB demonstrator
...that the development of propfan
...powered airliners was not yet justified,
...and further test work was
...curtailed in mid-1990. Boeing

ABOVE RIGHT: The MD-90 name now refers to the whole family of MD-90 models that started with the MD-81. This first flew on 18 October 1979 and was sold with JT8D-209 engines and seating for about 155 passengers. Swissair, along with Austrian Airlines, became the launch customer when it ordered 10 plus five options in October 1972. The first Swissair MD-81 service took place on 5 October 1980 operating a Zurich-Frankfurt round trip. By July 1997 Swissair was still operating seven MD-81s. Here is HB-INY which was completed on 24 February 1988, delivered on 28 March and named *Bassersdorf*. *Cris Dagit*

CENTRE RIGHT: The MD-82 first flew on 8 January 1981, powered by higher thrust JT8D-217s allowing improved payload and range or the ability to fly on hot and high continents. Here is B-2102, the second MD-82 to be assembled in China, delivered to China Eastern Airlines on 17 December 1987 to join the Shanghai fleets. China Eastern Airlines is based at Shanghai Hongqiao International Airport in the People's Republic of China and received its first MD-82, B-2101, on 4 May 1984. By May 1997 the airline was operating a fleet of 13 MD-82s. *MD*

RIGHT: The MD-83 offered improved power in the shape of JT8D-219s, carried more fuel and was an improvement in range. The extra fuel was located in two centre fuel tanks, one aft of the centre section, the extra weight required modified undercarriage, flaps and wings. It first flew on 17 December 1984 and was service flew with Alaska Airlines in February 1985 (see photo on page 37). This photo shows MD-83 TC-INC freshly delivered from Irish Aerospace on 3 April 1999 by Sonnevas Investment Holding Limited (which collapsed late in 1997). Sunway was an all-reserved charter passenger and cargo operator based in Antalya, Turkey. *Aerospace*

with the successful DC-9 series, but comfortable in the MD-90 cockpit. The MDC designers, with the influence of company and airline pilots, did improve the visibility from the cockpit, reduce clutter on the instrument panel, and make sensible changes to the aircraft's systems displays and controls.

Major changes are naturally not evident from the cockpit, but do extend the life to a family of twin-jet airliners that started with the DC-9-10 in 1965. The most significant change in the MD-90 is the replacement of the 21,000lb-thrust (93.4kN) Pratt & Whitney PW2037 engines, used in the MD-80 with International Aero Engine (IAE) V2500 series engines. This has a 25,000lb thrust (111kN) rating, with a 28,000lb (124.4kN) option. The new engine gives the noise levels well below Stage 3 requirements and even below potential Stage 4 levels. The V2500 engine also emits lower amounts of carbon monoxide, oxides of nitrogen and hydrocarbons.

Other improvements in the MD-90 include the installation of a new passenger interior and vacuum lavatories. A 4.75ft (1.5m) plug added to the standard MD-83 fuselage allows the new airliner to fly with a mixed class seating of 158 passengers, or a maximum of 172 seats. The additional length accentuates the comparatively small wings of the MD-90. They are essentially the same as those on the earlier DC-9 with added strength. The wing size also partially explains the maximum 77,000lb (34,927kg) certificated altitude for the MD-90.

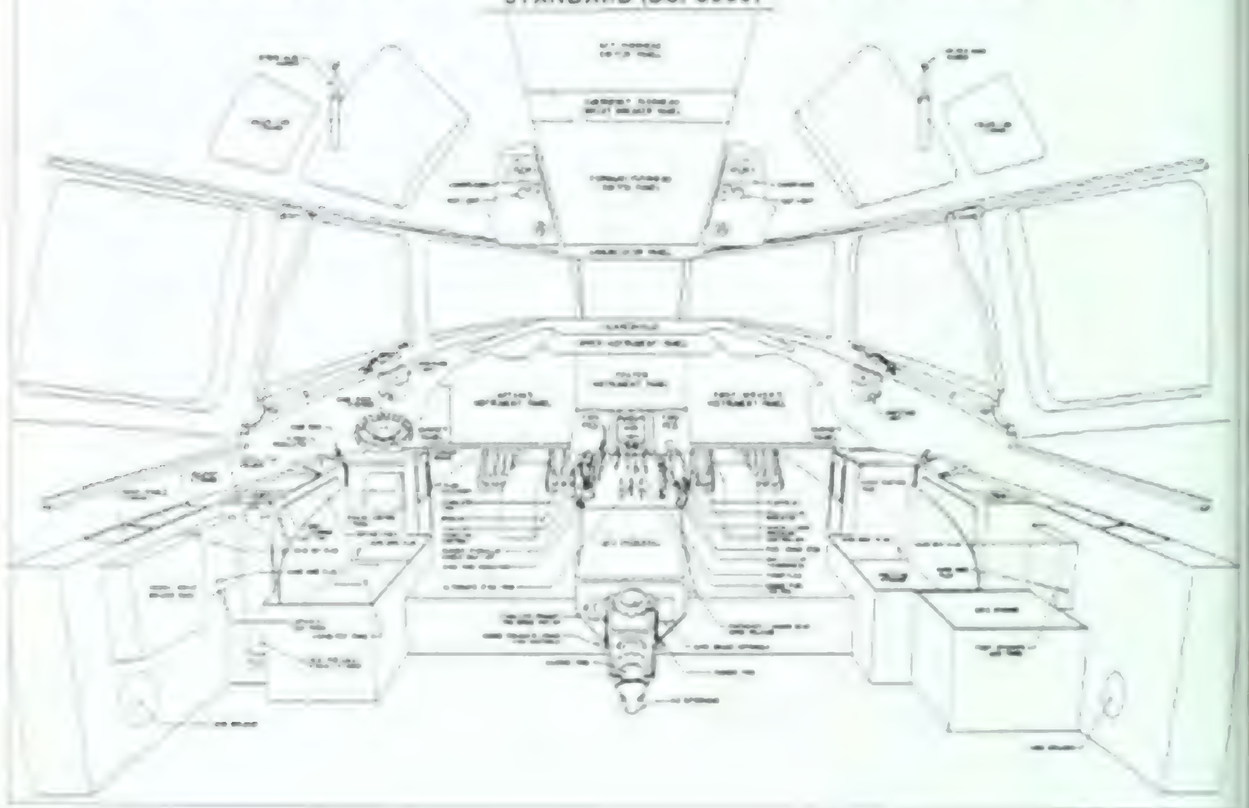
As is already well known, the Long Beach-built transports have a fine reputation for durability and long life, which explains why there are still more than the 2,000 DC-9 and MD-80 airliners still in service. The design service life of the DC-9 was 50,000 hours and 40,000 landings, and for the MD-83 was 60,000 hours and landings. The design service life for the MD-90 is for 90,000 hours and 60,000 landings. The combination of durability, excellent performance, cabin flexibility and quietness inherent in the MD-90 make it an excellent airliner for operators.

Austrian Airlines: The MD-87 is a shortened version of the MD-88. Its length of 147ft 10in (45.72m) is 6ft 8in (2.1m) shorter and it is notable for having the first EFIS cockpit of the MD-80 family. Powered by JT8D-217s, it has a tapered fuselage and a new tail as standard. Despite the smaller size than the MD-88, the MD-87 has a maximum range of 2,700nm (5,000km). The MD-87 first flew on 4 December 1986 on scenic duties. Austrian, along with Swissair and Southwest Airlines, had become the third launch customer for the MD-87 when it was announced on 31 October 1985, placing four orders for eight plus four options. Today, the Vienna-based airline operates five MD-81s, five MD-82s, nine MD-87s and five MD-87s. Depicted is MD-87 OE-LML Salzburg, which was completed on 14 November 1987 and delivered on 15 December. By the end of December 1990 it had flown 2,836 hours and 1,900 sectors and was employed on the Innsbruck–Graz–Vienna–Graz–Innsbruck route.

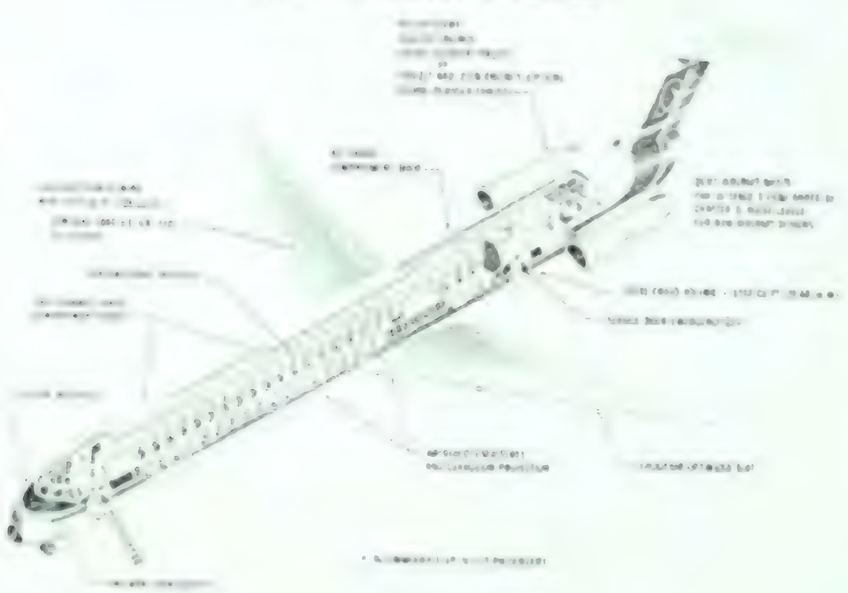
Midway: The MD-80 remained an order book bestseller for Douglas in 1988. It was then on its longest ever production run, to January 1999. It is similar to the MD-83 – although the three-engine jet followed by Delta some ten years ago remained unchallenged as the ultimate DC-9 variant, which in its day fulfilled many passenger and operational requirements, from short-range to medium-haul, with a maximum seating which usually was about 140 passengers. Midway Airlines is based in Chicago and at one time it had a fleet of 20 new MD-80s, two MD-88s, nine MD-82s and four MD-83s, all flying in a 142 passenger, all-coach, eight-abreast layout. One MD-87 (N980MD) completed in December 1989 and delivered in January 1990 was flying

SUPER 80 FLIGHT COMPARTMENT CONFIGURATION

STANDARD (DS/8000)



GENERAL CHARACTERISTICS



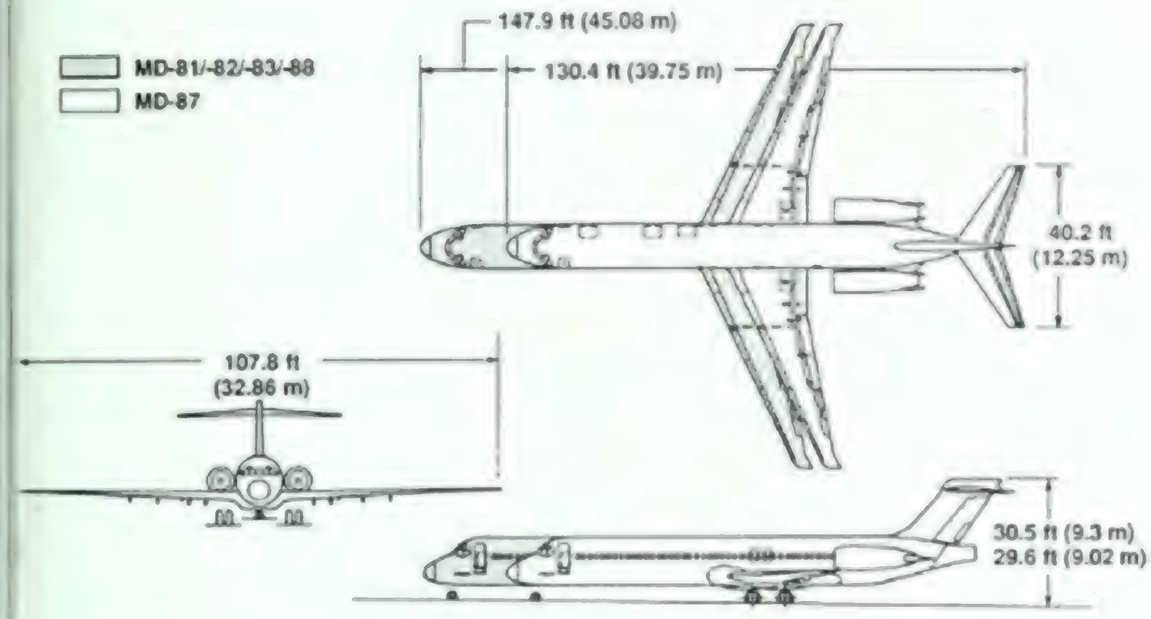
Above: Flight compartment configuration of the 'Super 80'. Note the two-man crewing arrangement, today universally operated but unusual in the late 1970s/early 1980s.

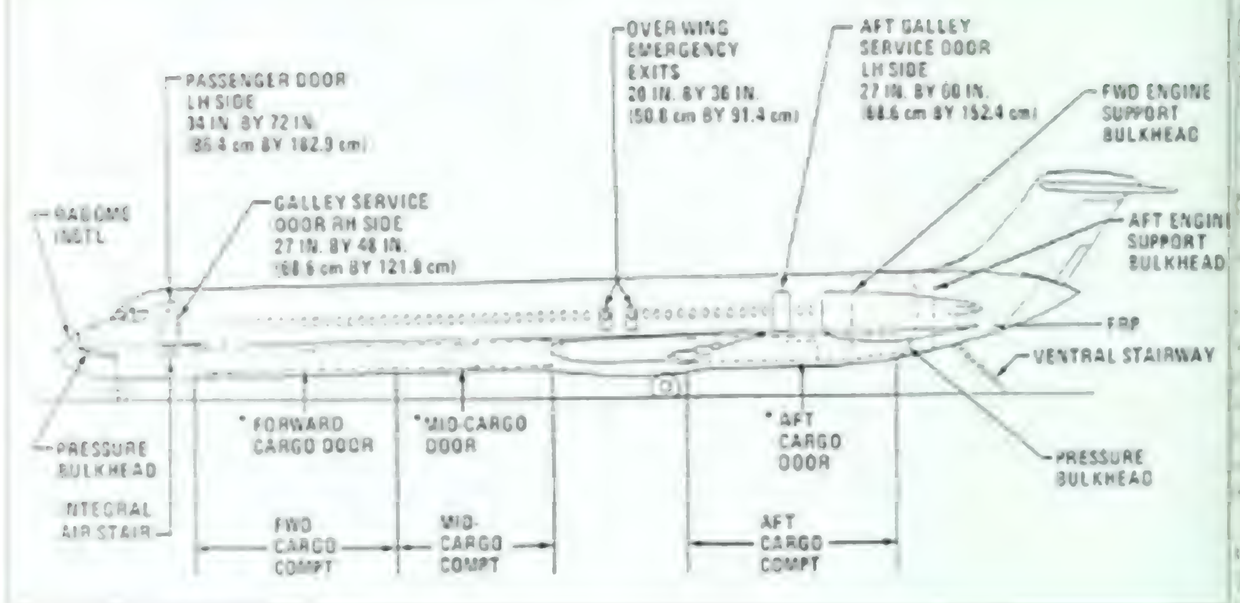
Left: MDC artwork highlighting the MD-80's general characteristics.

Above Right: General arrangement drawing of the family, showing graphically the shortened MD-87.

Right: Air Caledonia operated the MD-83 during 1981 prior to a merger with American Airlines and was involved in a thorough passenger survey. Although a majority rated all interiors as attractive, the dark contour and interior features of the MD-80, as seen in this photo, were rated 'very attractive' far more often than those of the Boeing 737 and 727. The MD-80's greater space per passenger resulted in higher comfort ratings.

MD-81/-82/-83/-87/-88, GENERAL ARRANGEMENT





While the internal requirement to maintain a common pilot ...e rating among the DC-9 series of aircraft has limited ...anges and improvements, the Long Beach designers did what ...ey could to ease pilot workload and improve situational ...areness. The addition of the EMI V2500 engines is another ...provement.

...RAINING

...ansition training from other airliner types was discussed with ...e Federal Aviation Administration (FAA), and it was felt that ...y pilot switching from the MD-88 to the MD-90 would only ...quire less than one day of training. The FAA flight test pilots ...signed to the MD-90 programme were proficient in six hours ...ansition training from other MD-80 series airliners involved ...ee days of ground school and a proficiency check with two ...ndings. Pilots new to the DC-9 Series would take 102 hours ...f ground and simulator training.

...ASSENGER OPINION

...he McDonnell Douglas MD-80 twin-jet in comparison with ...he Boeing 727 and 737 won praise from airline passengers the ...orld over. Results from five separate passenger surveys were ...markably similar, with the MD-80 consistently earning high ...arks for its personal roominess, ride quality, quietness, and ...ashion decor. More than 90 percent of 19,000 passengers ...rveyed in the United States, Europe, the Middle East and South ...America between 1981 and 1983 rated the MD-80 as 'appeal...ng'.

Surveys conducted by independent researchers in the USA that were co-sponsored by McDonnell Douglas and airlines ...also operate MD-80s and competing airliners, showed MD-80 ...references of 3 to 1 over the Boeing 757 and nearly 8 to 1 ...ver the Boeing 737. Under different passenger and service ...onditions in Europe and the Middle East, an Austrian Airlines ...urvey found that air travellers reaffirmed preferences for MD-...0s by wide margins.

McDonnell Douglas survey guidelines and objectives were ...to compare air travellers' experiences in MD-80 and Boeing ...7 and 737 airlines, and to validate strong MD-80 preference ...by surveying a variety of airlines' locations, economy and first-...class interiors, and passenger profiles. The method used ...involved interior feature ratings of the 737, 727 and MD-80 ...taken only from passengers flying in these aircraft. Preference ...ratings were permitted only when respondents recognised ...names and had opinions about each aircraft being compared. ...Respondents were given counterbalanced versions of the ques...tionnaire so responses were not weighted in favour of the Boeing ...727/737 or MD-80 airliner. Interviews were conducted by ...

...Above Left: Side view of Rolls MD-82 HB-INR which was completed on ...6 January 1985 and delivered on 1 February, showing the old tail and drag cone ...configuration.

...Centre Left: Fuselage structural arrangement. (Bill ...

...Left: Austrian OE-LML taken in 1987. (Jon Proctor)

...trained research personnel from ... research companies.

...On each flight, an interviewer chose a ... seat area for conducting the survey. ... rates were over 90 percent, and representative ... obtained. Although a majority rated all ... the check contents and interior features of the MD-80 ... very attractive, few rated them the best of the ... and 737.

...The following three statements were released by the airline ...research department:

...In coach, the MD-80 and a big-airplane winner ... Although ... are particularly with regard to seat comfort, washroom ... and quietness.

...Centre seat MD-80 passengers rated their airplane more than ... aisle seat Boeing 727 passengers.

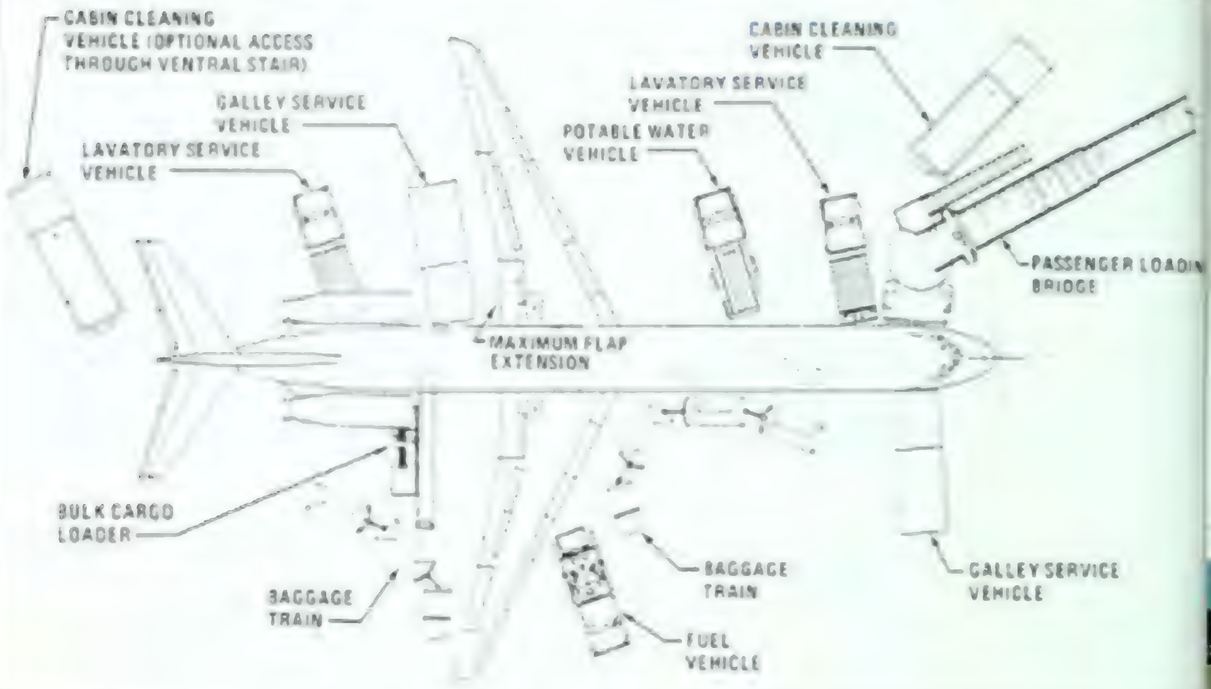
... A widening margin in favour of the MD-80 with increasing ... travel. More than three times as many frequent fliers rated the MD-80 very good (68 percent) than the Boeing 727 (18 percent).

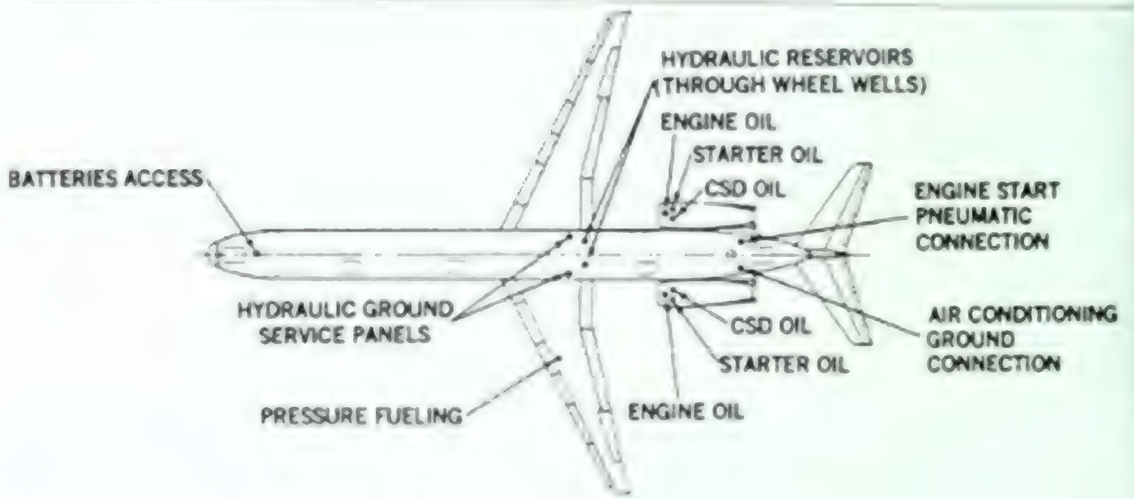
...Airline surveys independent of McDonnell Douglas involved a ...South American international carrier. Surveys taken in four dif...ferent regions totalling more than 8,000 respondents were per...formed from December 1982 through March 1983. Survey ...routes differed in flight lengths — less than one hour to more ...three hours, direct or multistop connections, and mix of busi...ness, tourist, and ethnic background of travellers. About 93 ...percent of all respondents surveyed rated the MD-80 as 'very ...good' or 'good' after having considered various specific interior ...features. Comparative ratings to MD-80 were sought only ...when the respondent had prior experience flying Boeing 737 ...and 727. The MD-80 was preferred over the Boeing 737 by 8-...to-1 and over the Boeing 727 by 6- to-1 when choosing among ...those three airliners.

The purpose of a survey carried out by a major US airline ...was to compare the MD-80 to the Boeing 727. The survey was ...conducted in June 1983 in five domestic markets. Total sample ...size was about 6,400 over 3,000 each in the MD-80 and the ...Boeing 727. The airliners surveyed were flown on the same ...routes with the same fares and were operated by the same air...line. Over 90 percent of all coach respondents surveyed in the ...MD-80 rated their airplane as 'good' or 'very good', with about ...twice as many giving the highest overall rating when in the MD-...80 — 46 percent compared to 23 percent in the Boeing 727.

MD-90 — MEETING AIRLINE NEEDS FOR THE 21ST CENTURY

...From 4 August 1997, MDC Long Beach became the Douglas ...Products Division of the huge Boeing Commercial Aircraft ...Group. Many employees were reportedly happy that the name ...'Douglas' had been returned to the aircraft. The re-creation by ...Boeing of the MDC empire for $13bn was not declared anti-...competitive and could proceed without changes. Though it ...cleared the transaction with no changes, the Federal Trade


CABIN CLEANING VEHICLE (OPTIONAL ACCESS THROUGH VENTRAL STAIR)
GALLEY SERVICE VEHICLE
LAVATORY SERVICE VEHICLE
CABIN CLEANING VEHICLE
LAVATORY SERVICE VEHICLE
POTABLE WATER VEHICLE
PASSENGER LOADING BRIDGE
MAXIMUM FLAP EXTENSION
BULK CARGO LOADER
BAGGAGE TRAIN
BAGGAGE TRAIN
GALLEY SERVICE VEHICLE
FUEL VEHICLE


HYDRAULIC RESERVOIRS (THROUGH WHEEL WELLS)
ENGINE OIL
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ENGINE START PNEUMATIC CONNECTION
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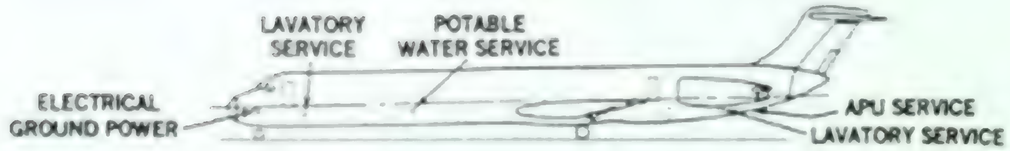
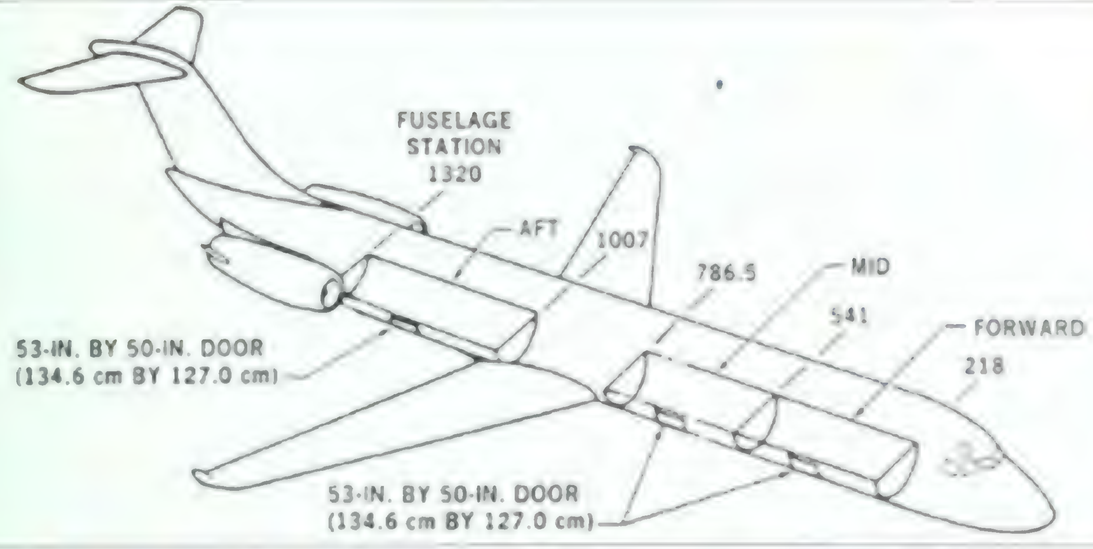

LAVATORY SERVICE
POTABLE WATER SERVICE
ELECTRICAL GROUND POWER
APU SERVICE
LAVATORY SERVICE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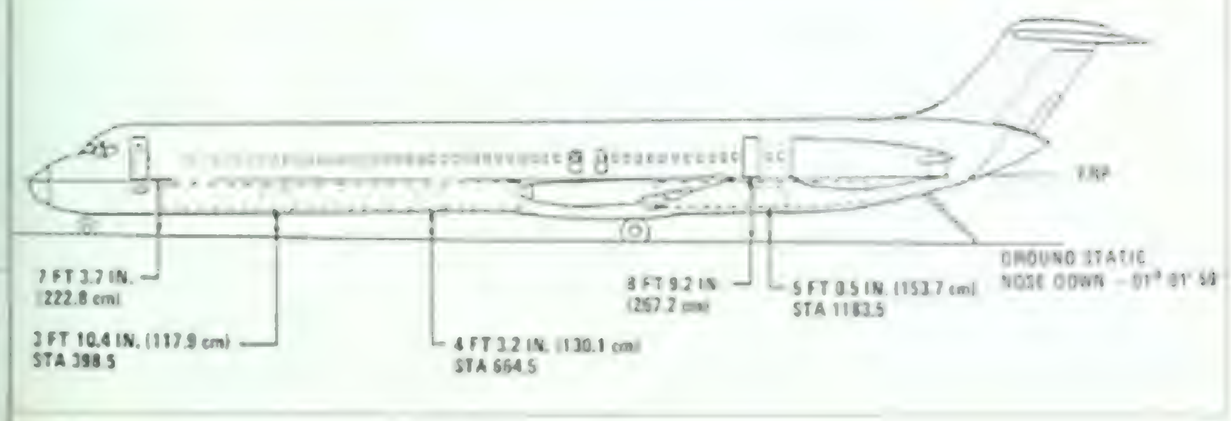
VENUS


7 FT 3.7 IN. (222.8 cm)
2 FT 10.4 IN. (117.9 cm) STA 398.5
4 FT 3.2 IN. (130.1 cm) STA 664.5
8 FT 9.2 IN. (257.2 cm)
5 FT 0.5 IN. (153.7 cm) STA 1183.5
GROUND STATIC NOSE DOWN – 01° 01' 50"

Commission (FTC) lent credence to the European Commission's concerns about the clauses that make Boeing the exclusive supplier to American, Delta and Continental Airlines over the next 20 years. It was evident that Boeing could become a

...on A1: Any clutter of round dial instruments used in earlier MD-80 airliners has been lowered in the MD-90 by using an electronic flight instrument system (similar to that in the MD-88) plus a full flight management system and an electronic overhead autopilot control panel. The wind shear computer and flight guidance and management systems have been modified for the MD-90. Because of the similarities between the various MD-80 variants, all carriers are saving thousands of dollars in crew training costs. [ED]

...ANGE LEFT: The MD-90 designation had applied to a number of proposed developments but when it came – first flying on 22 February 1993 – it was more than simply a stretched and re-engined MD-80. The most striking engine-related change was the new IAE V2500 powerplant, replacing the Pratt & Whitney JT8D of the MD-80 family. Other major differences between the MD-90 and 80 series were wing, a new APU, a lengthened forward fuselage and a new electrical generating system as well as a fully glass cockpit. Here SE-DMF shows off to good effect the new wing design on take-off. SAS took delivery of a batch of six MD-90-30 airliners. [ED]

...ANGE LEFT: The main version is the MD-90-30, which is designated MD-90-30T when built in China. Here B-17703 is seen at Long Beach taking off during acceptance flight trials. By the end of 1997 Uni Airways Corporation based in Taoyuan, Taiwan, had taken delivery of six MD-90-30 airliners. [Boeing Commercial Airplane Group]

...ABOVE: The editorial *Orange County Hour* (MD-90, N901RA c/n 53000 ln 2128) arriving to Reno Air seen on landing configuration at San Jose, California in December 1996. The airline operates 40 daily departures from its San Jose hub. The inaugural flight of the airline, Reno–Los Angeles took place on 1 July 1993 with an ex-Maberry MD-82. By summer 1998 the fleet had grown to 29 airliners – eight MD-82s, 14 MD-83s, four MD-87s and three MD-90s. By March 2000 a further MD-87 had been added, bringing up the fleet to 30. [Boeing Commercial Airplane Group]

...$40bn aviation behemoth that controls almost 70 per cent of the world's commercial aircraft market.

The event came just two years after Long Beach had celebrated the 75th anniversary of the founding of the Douglas Aircraft Company (DAC) and one of the events at the plant to highlight the company's years of innovative commercial aircraft designs, its latest two jet airliners the MD-90 was delivered to Delta Air Lines during June. This was N901DA (c/n 53001 which first flew on 27 August 1995, being christened *Spirit of Long Beach* by MD-87 registered N901R7, and delivered to Delta at Atlanta on 4 June 1995.

Ronald W. Allen, Chairman, President and Chief Executive Officer of Delta, said:

"The MD-90 is an aircraft designed for Delta's future. From the start, we participated in writing the specifications for this aircraft to anticipate just where our industry and our company are headed."

Commencing in 1989 the airline had provided hundreds of its employees to finance, infrastructure and design engineers to MDC – design teams at Long Beach. With many the results of the combined four-year effort, Delta placed a firm order for 63 MD-90-30s with an option for an additional 100. By March 1997 39 MD-90s were registered to Delta with a follow-on 32 additional airliners taking delivery by 1998.

The plan for the MD-95 was to incorporate the most advanced airliner in the stretched MD-90 family, the MD-95, so that it would be capable of meeting anticipated Stage 3 noise reduction levels, reduce the engine exhaust smoke, increase fuel efficiency and cut down on the level of cabin emissions. The

AIRMAX: One of the two prototype MD-90 airliners seen on flight over the Sierra Nevada mountains in California during a routine test flight. The additional fuselage length accentuates the comparatively small wingspan of the MD-90. They are essentially the same wings as those on the earlier DC-9 airliner family. Elite

OVERHEAD, INSET RIGHT: By November 1990 more than 800 hours of wind tunnel testing had been completed on this model of the new MD-90, now in production at Long Beach. The model demonstrated aerodynamic characteristics of the new airliner powered by two International Aero Engine V2500 engines. It was installed in the 11ft (3.35m) transonic wind tunnel at the NASA Ames Research Center at Mountain View, California. The MD-90 first flew on 22 February 1993 and after FAA certification in late 1994, the first delivery to the launch customer, Delta, was made in February 1995. It entered revenue service (see assembly line) and by March 1997 it was being used by 30 operators including 95 aircraft. Photo

OVERLEAF, INSET LEFT: The nose structure for the first production MD-95 airliner was laid down at Long Beach early in 1997. The MD-95 is similar in size to the successful DC-9 Series 30 and is being built in response to the growing 100-seat narrow body airliner market. It is powered by two BR715 turbofan engines which enable it to be quieter, cleaner and more efficient. The MD-95, redesignated Boeing 717, is designed for short to medium range routes where larger aircraft are less economical to operate. Mike

OVERLEAF, MAIN PICTURE: In flight from Long Beach is MD-90-30 N901DE, the prototype that made the first flight. The new MD-90, now in service, is the quietest large airliner and exceeds both US and IAE V2500 engine noise requirements. Production of the MD-90 is forecast to continue into the next century. Jerry

'When we wanted to improve on the MD-80, clearly noise was one of the most important improvements we could bring to the design. The new engine brings improved economy and it may well bring improved reliability, but it also had to bring improved acoustical properties'

The V2500 series of turbofans is reputed to be 10 percent more efficient than the JT8D series which powers the MD-88. At current jet fuel prices, Delta forecasts that they will save $1,000 per year, per aircraft when compared to the fuel bill of the MD-88. This was confirmed by IAE President Robert Saiz who said,

'Experience has shown that the V2500 will save Delta money in operating costs, while providing the reliable, on-time performance passengers expect. It's a rugged, dependable engine that incorporates the best technology from around the world.'

ENVIRONMENT

With many European countries following the USA in regulating engine exhaust emissions, it is claimed that the V2500 series produces less than one fifth of the pollutants as established by international aviation regulations.

The solution to reducing the MD-80 series noise signature, begun with the new turbofan, is further reduced by the rear fuselage engine mounting — common to all DC-9/MD-80/MD-90/MD-95 series airliners. When integrated with an 'airport neighbour friendly' flight profile, the wing shields those on the ground from turbofan noise on final approach. The quiet airliner meets FAR 36 Stage 3 — ICAO Annex 16 Chapter 3 noise levels introduced for new aircraft designs. The Group Leader for Acoustics from the Aerodynamics and Acoustics Design and Technology group, Daryl N May PhD said


MD-95
95


NASA
MD90


MD-90
V2500
ME


MCDONNELL DOUGLAS
90

5 In Service

Within a decade of the MD-80's introduction, 64 airline operators across the world had taken delivery of airplanes of the series. Operators of both the Douglas DC-9 and the McDonnell Douglas MD-80 twin-jets are found mainly in Europe and the Americas, but also significantly in Asia. As well as these airlines — many of them long-time Douglas customers — can be added operators who briefly 'wet'-lease airliners. Among the many lease companies and operators are numbered some first-time buyers with infants acquiring pre-owned airplanes.

An increasing role is being made by the many leasing companies and banks which enables airlines to operate the very latest McDonnell Douglas product, without having to expend the vast sums of cash necessary today to purchase a new airliner. Quoted price for an MD-81 can range from $18m rising to near $40m, or even more for the very latest MD-88. The many leasing companies who have purchased quantities of the MD-80 series include Guinness Peat Aviation — Irish Aerospace, the Beverly Hills based ILFC, and Polaris Leasing of San Francisco.

Launch orders from Austrian Airlines (eight firm plus four options), Southern Airways (four firm and four options), and Swissair (5 firm plus five options) enabled MDC's announcement of a DC-9 Series 80 on 19 October 1977. It could have been known as DC-9-70 or Series 70, but with service scheduled for 1980, it was marketed as the Series 80 or Super 80.

Swissair and Austrian Airlines became the MD-80 series' first operators. The first MD-81, HB-INC Thurgau (c/n 938 s/n 48005), first flew at Long Beach on 12 August 1980 and was delivered on 12 September. Swissair's first MD-81 service was on 3 October 1980, from Zurich. It operated a total of 24 of the 109 and 'Orca'-class MD-81s and in the spring of 1993 was scheduled to lease additional airliners from Guinness Peat Aviation, putting the MD-81 fleet to 26. By April 1997 Swissair had reduced its fleet to just nine MD-81 airliners.

The later MD-80 variants entered service as follows: MD-82 with Republic Airlines in August 1981, MD-83 with Finnair in July 1986, MD-87 with Austrian Airlines and Finnair in November 1987, and the MD-88 with Delta Air Lines in January 1988.

A very launch customer for the MD-80 series was Austrian Airlines, which took delivery of its first MD-81 (OE-LDP

[illegible] Piedmont Airlines, a US operator in the late 1980s, was the first [illegible] to operate the MD-80 using four JT8D-powered MD-83s. One aircraft is [illegible] with TWA.

[illegible] the national airline of the Turkish Republic of Northern Cyprus is Kibris Turk Hava Yollari. Here a MD-83 (c/n 49110, KTH) is framed in March 1993.

When, c/n 924 s/n 48051 on 16 May 1984. The type commenced service between Vienna and Zurich on 28 October 1984, while the short-fuselage MD-87 variant opened a Vienna to Zagreb service on 17 December 1987.

It is interesting to note that OE-LDP was manufactured on 10 August 1979, then operated by MDC at Long Beach as N1137Z. It was re-registered N1002W in June 1980, a registration it carried on pre-delivery test flights before acceptance. By April 1997, Austrian was operating seven MD-81s, five MD-82s, two MD-83s and five MD-87s.

Pacific Southwest Airlines (PSA) was the first US carrier to fly the MD-80 — it began a service in California from San Diego on 17 December 1980, following a long association with Douglas products. A Douglas DC-3 opened PSA operations on 6 May 1949, operating between San Diego and Burbank, and the airline prospered with a DC-9 fleet. In August 1978 it ordered 10 MD-81s, the first of them delivered on 14 November 1980 (N924PS, c/n 946 s/n 48034, completed 15 July 1980 and named *City of Burbank* during 1988). The fleet grew to 20 MD-81s and 11 MD-82s, both in 150-passenger versions, but five more on order were cancelled.

California, Arizona, Nevada, New Mexico, Oregon and Washington were all served by the PSA MD-80s, through until 9 April 1988, when US Air took over PSA. The pathfinding MD-81 N924PS was re-registered N800US in October 1990 and is still in service with US Air.

The private Argentinian airline Austral Lineas Aereas based at Buenos Aires-Aeroparque, has two MD-81s and two MD-83s. It took delivery of its first MD-81 (N10022, c/n 949 s/n 48024 named *Estrella San Carlos*) on 8 January 1981. The airliner was completed at Long Beach on 15 August 1980. The 155-passenger MD-80s are scheduled mainly on the airline's busiest routes from Buenos Aires to Bahia Blanca, Cordoba, Mar del Plata, Mendoza, Rosario and Tucuman.

By the end of December 1997 the MD-80 inventory statistics revealed that no less than 1,150 of the series were in service with 61 operators worldwide. This consists of 96 MD-81s, 589 MD-82s, 1,232 MD-83s, 75 MD-87s and 158 MD-88s.

But pride of place for the largest fleet must go to American Airlines which has a fleet of 270 of the MDC airliners — 134 MD-82s and 26 MD-83s. In October 1982, American picked up an offer from MDC to lease its initial MD-82s for two years. 67 MD-82s were bought by American in February 1984 and options taken on 100 more. With 165 MD-80s in service in 1989, American was calculated to have had the largest fleet of any single type of aircraft outside the former USSR, and it had 135 more MD-80s on order or option. Delta Air Lines is today second on the list with 120 MD-88 airliners in operation.

AIRLINER FINANCE

The list of DC-9 and MD-80 family operators is a lesson in practicality with airlines spread around the globe. The fleet size for added others also are very varied for short periods of time. Some have found a home with corporate owners, private companies and organizations some that lease buyers, others acquiring their airliners on the huge second hand market.

Today there is an increasing role involving leasing companies and banks. All enables airlines to operate the very latest equipment, airliner, without having to expend the vast sums of money necessary for the purchase of new equipment. In the case of the MDC twin jet airliners, the prices can range from around $30million for the basic MD-82, to more than $40million for the sophisticated MD-88 with its updated avionics.

The list of companies could only involved in the leasing of commercial jet transports is voluminous and their airline businesses is difficult to record accurately month by month. In the U.S. alone of the world's major leasing companies the first specializing the MD-80 series is Aerospatiale Leasing Inc of Golden, Colorado with one MD-82 acquired in November 1987 for lease to Southwest Airlines, whose 1990 airliner listing indicates nearly 80 airliners on lease from various companies large and small.

Possibly one of the largest leasing companies today is Ansett Worldwide Aviation Services based at Bedford, Australia and formed in September 1985 to manage the leasing of aircraft, plus purchase and resale of used aircraft. It has the MD-83 on its list with at least 10 on lease to TWA. GATX Air based in San Francisco has been operating since 1981, and by 1988 had MD-82s leased to both Alaska Airlines and TWA. Between 1981 and 1989 it installed a total of 24 MD-82 airliners.

MAJOR LEASING CUSTOMERS

The GPA Group, the Irish company built up from nothing over the past two decades by Tony Ryan, has today become one of the world's leading aircraft leasing concessionaires. It manages a fleet of nearly 300 jetliners covering a wide variety of modern types, including many from the MDC plant at Long Beach. The group makes more than half its profit selling aircraft, ranging from operating leases to third party investment.

Irish Aerospace Ltd, also based in GPA House, Shannon in County Clare, was formed in December 1986 by the GPA Group and MDC, specifically to lease the MD-80 series airliner, now holding a 16 percent share. In November 1987 Mitsui of Tokyo acquired 25 percent of the IAL shares. By 1989 the company had 20 MD-83s in service with two MD-82s and 12 MD-83s on order from Long Beach, the latter deliveries extending to 1991. Airliners were leased to Iberia Air Lines, Minerva and Spantax.

Big fly of MD-90 airliners are negotiated with MDC many conditions as leasing of requirements for a period later to customer worldwide. Initially the Irish national concession IAL is allocated to the new airliner and ordered throughout a large number of states covering a wide variety of airline business. These are listed for short periods showing the increased trade spread.

The Polaris Aircraft Leasing Corporation of San Francisco is a subsidiary of the Polaris Holding Company of which 85 percent is owned by the General Electric Capital Corporation and 15 percent to the founder of Polaris, Peter Pfendler. Lease figures for 1990 showed nine MD-82/83/88 airliners in service with TWA with 12 on order plus two options.

United Aviation Services (UAS) is a Panamanian registered company with international offices in New York, Paris and Geneva. It specializes in leasing, sales and financing of used Boeing and MDC airliners. The fleet summary for 1989 included two MD-83s for Hawaiian Airlines.

Based in Beverley Hills, California, is International Lease Finance Corporation (ILFC), a company formed in 1973 by Leslie T. Gonda as chairman, Steven F. Udvar-Hazy as president and Louis L. Gonda as executive vice president. In 1985 the company made a public equity issue equivalent to 26 percent of the company's shares and ILFC concentrated on operating leases. Leases which were current in 1989 included five MD-82s with one for Alaska Airlines, three for Continental, two for TWA, the MD-83 three for Air Liberte, one for Alaska, four for Potech Island Airways and one for British West Indies Airlines International (BWIA) the national carrier of the Caribbean islands east of Trinidad and Tobago.

AMERICAN AIRLINES

Established in 1934 and founded as direct successor to American Airways, formed in 1930, with other predecessor companies dating back to 1926, today American Airlines is one of the world's largest carriers, operating services to more than 160 cities throughout the world. Its current chairman and chief executive officer, Robert L. Crandall, has been responsible for establishing marketing alliances with many other operators including China Airlines.

In the early 1980s American pinned its medium term future to MDC by making the MD-80 series the object of what appeared the largest airliner order in history. It placed an order for 67 MD-82s, taking on option a further 100. It already operated 20 of the type under an operating lease agreement, taking delivery of a further 13 in 1984, so it was forecast eventually the fleet number could reach 200. This meant the airline would operate the largest airline fleet of any one type in the world (with the lifely exception of the former USSR). If all orders and options had been exercised, American's MD-80 fleet would have eventually reached a staggering 350 airliners.

In any case this was proudly representing the largest airline at you free to history in terms both of the money involved and aircraft numbers. Unlike the final MD-80 deal American struck with MDC, the new order was an outright buy direct from the

Above: Boeing Aspen Air System operates a varied fleet of airliners including the DC-9, DC-10, MD-80 and seven recently 13 MD-90s in airliners. Seen at Long Beach is DA 9000. *Richard Lynch Aviation Images*

Below: Orange County Flyer at Reno airport, Nevada, the home base for Reno Air which is now equipped with a number of MD-80 the airliners. The airline also uses the MD-82 and MD-87. *Author*

manufacturer. No financial details were released, although it is known that the MDFC Finance Corporation was involved. United States airline analysts believed that the deal contained large price concessions for American.

It was estimated that the airline was paying between $18million and $20million per aircraft, whereas MD-80 sales at the time had been estimated at $24million to $29millioneach aircraft. It is known that when the first order for 20 twin-jet airliners was placed in September 1987 attached was a unique lease agreement with MDFC whereby the manufacturer agreed to carry not only the cost of training, but also of major maintenance. In return for a low rental, American agreed to share the profits of its Boeing 727 and MD-80 fleet. The initial lease was for five years to enable the airline to transfer to an all-new 150-seat airliner. Consideration was rumoured at the time of American acquiring the new MD-90 or possibly re-engining its MD-80s.

The airline did not deny reports indicating that the terms of the agreement included attractive re-delivery payments, modest cancellation penalties, and improved terms on the existing leasing agreement covering the first 20 MD-80s. At a price of $39million in 1984, a firm order for 167 new aircraft would be worth some $4,630million.

There was a decision date for each group of MD-80s some 24 months prior to delivery. American was due to receive 25 aircraft in 1985 and 1986 and 17 in 1987 with an option open for eight more in 1987. From 1987 to 1991 the groups were reduced to 10 aircraft. This order took the MDFC backlog of MD-80 deliveries to 150 aircraft.

The entire 176-aircraft order was to be worth some $7.6million to Pratt & Whitney. American would require a total of 882 JT8D-200 series turbofans including spares, and each engine was priced at $2million.

It was the intention of American to utilise its new MD-80 fleet, each fitted with 142 seats in a dual first and economy class layout, to expand its Dallas Fort Worth and Chicago hub operations, and to increase its presence in transcontinental and strong business markets. Chairman Bob Crandall estimated the new MD-80s, together with new labour agreements, would cut operating costs to 14 percent. In 1984 American Airlines was operating into 108 airports in the United States with a mixed fleet of 244 aircraft. By January 1997 it was operating a fleet of 669 aircraft flown by a staff of 9,000 aircrew and in July 1997 operated 234 MD-82s and 28 MD-83s in that fleet. The first MD-82 N200AA completed on 14 January 1985, f/n *1097*/*49181*, was delivered on May 12.

The impact of the American Airlines MD-80 order resulted in a further 1,000 staff increase at Long Beach during 1984, and increase in the production rate of more than 4more/aft. The 1984 employment figure at MDC Long Beach was quoted as approximately 12,000 with 6,500 working on the MD-80 programme alone. President Jim Worsham revealed that MD-80 production would increase from less than one airliner a week to 1.41 a week by January 1984.

The McDonnell Douglas Finance Corporation supported MDC in Long Beach airliner marketing of the MD-80 airliner. It assisted the manufacturer and its airline customers in structuring and negotiating the financing portion of aircraft sales. The MDFC has also aggressively sought business opportunities related to the MD-80 twin-jet airliner for its own portfolio.

During 1984 MDFC entered into lease transactions for five MD-80 aircraft which increased to 12 the number of MD-80s in its portfolio. Commercial aircraft leased during that year included MD-80s for New York Air, Pacific Southwest Airlines, and Midway Airlines. The finance company extended $94.5million of financing to airline customers in 1984, which represented the third largest aircraft volume year in the then 15-year history of the MDFC. As of 31 December 1984, the commercial aircraft portfolio included 55 owned MDC aircraft leased to airlines and aircraft related receipts amounting to $390.4million.

MD-95 — WORLD'S BEST 100-SEATER

At least one Long Beach product now seems set to take the MDC tradition forward into the 21st century. The first Boeing 717-200, which started life as the MDC MD-95, was rolled out at the plant in June 1998.

In August 1994, MDC at Long Beach issued background information on the new MD-95 twin-jet airliner the company was offering to airlines. This 109-passenger airliner was designed to meet the need for an advanced technology aircraft built for short to medium range routes. It would be similar in size to the popular DC-9-30 series, of which 660 were built out of the total DC-9 production of 976.

First announced in 1991, the new design had a wing span of 93ft 0in (28.35m) and an overall length of 119.3ft (36.4m). Maximum take-off weight would be 114,000lb (51,710kg) compared to 108,000lb (48,988kg) for the DC-9-30 model. Two versions were being offered: the MD-95-30 with non-stop range of 1,575 statute miles (2,535km) and the MD-95-30ER extended range with an optional auxiliary fuel tank for up to 2,024 miles (3,257km) non-stop service.

Like all the MDC twin-jet airliners, the MD-95 design has a five-across coach seating arrangement. It incorporates cabin features developed for the current larger MD-90 jetliner including larger overhead baggage racks. The two-crew cockpit design features advanced technology systems developed for the MD-90, including an electronic flight instrument system, fully automatic flight management system and electronic displays for engine and system monitoring.

Power was to be provided by two BR-715 turbofan engines produced by the international consortium of BMW in Germany and Rolls-Royce in the United Kingdom. For the MD-95, the engine is rated at 18,500lb (82.2kN) of take-off thrust, with an increase to 20,000lb (88.96kN) possible for the MD-95-30ER airliner. The engine features lower fuel consumption, reduced exhaust emissions and significantly lower sound levels than the turbofans on similar-size airliners now in service.

Long Beach was thus offering to meet airline needs for fleet expansion in the 100-seat category airliner, and also as a replacement for hundreds of DC-9s still in service. It is interesting to note that as of July 1997 there were still 864 DC-9s in service with 70 operators. The MD-95 would also be able to replace other similar airliners being made obsolete by virtue of new plus stringent new regulations imposed on airport noise and engine fuel emissions. Deliveries were forecast to commence in 1998.

LAUNCH ORDER

In the autumn of 1995, an order for 50 airliners with an option for 50 more came from the US based ValuJet, which spurred the start of production on the MD-95-30. The over $1billion order came from this Atlanta-based low cost carrier, formed in 1993 and offering low fare scheduled jet services to short haul destinations. A rumour that ValuJet had signed a letter of intent to purchase 25 Airbus A319 airliners in a $1.5billion deal was subsequently denied by Airbus Industrie.

Operations by ValuJet commenced on 26 October 1993 and the fleet by early 1996 included no less that 43 DC-9-32 airlin

[illegible] Result: On 18 June 1990 Saudia Arabia Airlines ordered no fewer than 29 MD-90-30 airliners from Long Beach. The largest air carrier in the Middle East [illegible] operates international scheduled and charter services as well as domestic passenger and cargo operations. Shown at Long Beach towards the end of 1997 is HZ-AFB performing taxi and braking tests during acceptance flight trials. *Michael Ann Acee (Via G. Jones)*

[illegible]: MD-83 D-ALLR was delivered to the Aero Lloyd on lease on 26 June 1991. Today the German carrier has 15 MD-83s.

[illegible]: McDonald joined with the Swissair subsidiary Crossair and Swissair creative Headplan to provide the unique livery on MD-81 HB-IUH. Passengers flying aboard McFlyer, as it was called, were even able to enjoy McDonald's hamburgers on certain routes. *Crossair*

ers with a single class seating for 133 passengers, five DC-9-21s, four DC-9-41s, one MD-81, two MD-87 and two MD-88s. There was a reduction in the fleet and no operations were flown between 15 June and 30 September 1996.

The airline anticipates the 160-seat MD-95-30 will provide a 7 percent cost per available seat mile advantage over the DC-9. On peak travel days the airline had been operating 230 daily system departures to 76 US destinations.

Announcing the launch order, John Wolf, executive vice-president of development at MDC Long Beach said:

'More than 500 people, including flight attendants, airline executives and a cross-section of passengers from around the world, evaluated the full-scale mock-ups of the MD-95 and we developed an evaluation process to identify cabin features considered most important. The new MD-95 interior features reflect that evaluators' response.'

Early in 1997 the nose structure was handed over for the first production MD-95, this being contracted to Korean Aerospace. A team of both national and international contract partners from around the globe are supplying components and sub-assemblies to Long Beach, where the MD-95 is being constructed. Quality assurance and inspection, flight testing, and airworthiness certification will involve many many hours before the new airliner is turned over to any customer.

An announcement during August 1997 indicated that the airline title ValuJet had disappeared as the latter had purchased AirTran, a Boeing 737 operator, and was painting the fleet's airliner fleet in AirTran livery.

THE FUTURE OF LONG BEACH

Long Beach, now having become a component of the Boeing Boeing Commercial Airplane Group, was due for change according to news released at the end of 1997. Boeing decided to end production of the MD-80 and MD-90 in mid-1999, but would support the production of 80 MD-95s ordered by AirTran (ex ValuJet). Seattle was to decide on the MD-9 long term 'regional jet' future, possibly including a 70-seat v sion in 1998, however it was already known that Boeing inte ed to cut the cost of producing this new airliner.

The removal of the MD-80 and MD-90 from the air market — both of which it has been showing a gradual decre in sales — was expected to benefit both the Boeing 737 and 757. The two Long Beach produced aircraft had a backlog 104, mostly MD-80s. During 1997, only 16 MD-80s and MD-90s were delivered.

A life-extension came, however, when an order for 24 M 83s for TWA was announced on 21 April 1998, taking the es mated life of the Long Beach twin-jet assembly line to Janu 2000. The value of the TWA order is about $1.2billion (at price). TWA had eight MD-83 deliveries pending from a p vious order. But Boeing repeated its announcement that M 80 and MD-90 twinjet production will be phased out wi current commitments are met.

The new order will boost the TWA fleet to 164 MD-

TWA also operates 58 DC-9s. Each of its new MD-83s will have 20 first class seats to an overall 142 passenger capacity.

BOEING 717-200

In January 1998, Boeing announced that it had changed the designation of the Long Beach produced MD-95 to Boeing 717-200, bringing the twin jet into the designation system of the Seattle-built commercial jet. Historians will recall with interest that the Boeing 717 designation was allocated to the military Boeing 707 known as the KC-135 Stratotanker. Ron Woodard, President of the Boeing Commercial Airplane Group was quoted as saying:

'The 717-200 is uniquely qualified to meet the evolving requirements of the new regional jetliner market. It's a 100 seat market that demands comfort, low operating costs and high schedule reliability. This is the plane to meet that need.'

The two-crew cockpit incorporates the industry's most modern and proven avionics technology configured around six interchangeable liquid crystal display units. The flight deck features include an Electronic Instrument System (EIS), a dual Flight Management System (FMS) and a Central Fault Display System (CFDS). In addition, Global Position System (GPS), Traffic Alert and Collision Avoidance System (TCAS) II and Future Air Navigation Systems (FANS) are available as optional features. An advanced Honeywell VIA 2000 computer is also installed.

The MD-95/717-200 is designed to replace thousands of 100-seat aircraft now in service and to offer superior economics in the 100-seat category. The 86,500 pound (39,300 kg) maximum takeoff weight version has a 1,990 nautical mile (3,700 km) range capability in all-economy seating configuration. A 98,500 pound (44,800 kg) maximum takeoff weight version follows on model.

Way back in August 1996 it was announced that a stretched version of the MD-95 regional derivative was under study, and that the manufacturer that Boeing believe a 120 to 130 seat version of the MD-95 would be suited to the busy commuter airliner market. Shrinking the Boeing 737-X2 (the name would make it look like a 'far eight', according to one Boeing official, whereas the MD-95X increases fuselage, with two more abreast seating and two stand-up lavatories appears to offer a real advantage over competitors.

On 4 May 1998, Bavaria International Aircraft Leasing Company of Munich became the first European customer for the 717, when it ordered five 717-200 with deliveries scheduled in late 1999 and into 2000. The company said it saw considerable demand for 100 seaters, and there was no alternative model on the market — the 737 said Bavaria, was likely to find favour over turboprop aircraft still on the market. Later the same month, more than 80 European airlines and leasing companies attended a Boeing 717 assurance conference in Berlin which Boeing saw to an encouraging indication of interest.

The first 717-200 was rolled out at Long Beach on 10 June 1998. Five airplanes were in final assembly at the Douglas Products Division and first flight of the 717 was expected in September 1998. Deliveries to customers were scheduled to begin in summer 1999.

6 AIRLINE OPERATORS

MD-80 CURRENT FLEET AND ORDERS

Operator	Code	81	82	83	87	88	Total
Aero Lloyd	XLL			10			10
Aerolineas Argentinas	AR			11		4	15
Aeromexico	AMX	13	2	3	10		33
Air Aruba	ZVA			3		3	6
Air Jamaica	JM			7			7
Air Liberte	ZIL			8			8
Alaska Airlines Inc	AS		6	34			42
Alitalia	AZ		30				30
Allegro	ZNU			5			5
ALM Antillean Airlines	LM		6				6
American Airlines Inc	AA		230	20			250
Ansett	ZTA			12			12
AOM-Minerve SA	FWU			11			11
Austral	AU	2		2			4
Austrian Airlines	OS	6	3	3	6		18
Avianca	AV					10	10
Aviogenex	MAV	11					11
Braathens	ZAZ		8				8
Britannia Airways	ZB			3			3
C.P. Aviation Services	CSV		6				6
China Eastern Airlines	CSS		11				11
China Southwest Airlines	CSN		10				10
Continental Airlines	CO	5	34	4			43
Crossair	CR	4	3	2			9
CSA	CSA		3				3
Delta Air Lines	DL					120	120
Ghana	GHA	2		4			6

Operator	Code	81	82	83	87	88	Total
Edelweiss Air	ZLY			6			6
Euralair SPA	ZOR			6			6
Finnaire	FAN	2					2
Far Eastern Air	FE		2	2			4
Fawaz	SV	11	12	6			29
Ford Motor Co Ltd	FFD				2		2
GE Capital Aviation Services	GEC			3			3
Golden Nugget Aviation	ZGC				1		1
Great American Airways	ZGM				1		1
Iberia	IB				24		24
Jersey Sky Tours	JT	6			4		10
KLM Aircraft Sales Inc	ZAV				1		1
Kuwait Air Lines	KE		11	3			14
Kuwait Airways	KUW			1			1
Martinair	MT		9				9
Midwest Express	XYX					2	2
NKR (Delaware) Inc	NKR		1				1
South American Airlines	SGS			1			1
Northwest Airlines	NW		9				9
Nationair	VLO			4			4
Ohio Air	OHY					2	2
Ohio Corporation	ZAI				1		1
Rant Air	XQQ			5	14	7	26
SAS	SK	28	23	4	18		73
Spantax	ZAB		3	15	2		19
Sun Air	BVZ		4				4
Surinam Airways	PY				1		1
Swissair	ZSC		7				7

Operator	Code	81	82	83	87	88	Total
Tower	HR	1					1
Tradal and Tidvatn	BW			1			1
TWA	TW		10	30			41
Varig	ZNT		6				6
Viasa	LV	10	11				21
TOTAL AIRPLANES		96	589	232	75	158	1150

MD-90 INVENTORY STATUS

Operator	Code	30	30ER	Total
AC Aviation	AAH		1	1
Asia Eastern Airlines	YSA	4		4
TOTAL AIRPLANES		66	1	67

[illegible] Resplendent in the new colour scheme is TWA MD-83 N951TW at Ama, Florida, during 1986. Completed on 4 June 1985 it was delivered to Aerospace Enterprises Inc, being purchased by Ford Motor Credit Corporation and to Ansett Worldwide Aviation Services (AWAS) with a sub-lease to TWA, all the same day — 10 July 1985. [illegible] August

LEASING

Above, Right and Below Right: There are scores of examples of MD-80 series leases, subleases etc., far too many to record in detail. Often this also involves a complete change of airline livery and registration. These three examples depict MD-83 (s/n 49629 above history is a prime example.

Completed 26 March 1989 as EC-GRO (Build 1453) for Iberia, it was delivered on 15 May and leased to Gem Airlines the same day. There it was re-registered EC-EOV on 25 June. Returned to Iberia Aeropuertos on 4 November 1990 it was leased to Aeroservicios as VH-BMH on the same day. On 14 October 1992 it was subleased to Private Air Expeditions, probably USA and in December 1992 it was sub-leased to Oasis again becoming EC-525 then EC-FYB (Bitcoin Report) in March 1994. Currently it is HB-IKP (Built) with Edelweiss, still under the original build number 1453.

Above: The MD-82 PJ-SEH (s/n 1492 c/n 49961, photographed at Miami in 1988 was completed on 7 February 1988 as N1104J for Texas Air but not taken up. Sold instead to GPA Group Ltd as EI-BUV it was again not taken up. It then went to GPA as F-HBWB on 10 March 1988 and leased to ZAS Airlines of Egypt becoming SU-BMR on 20 April. It was leased again to Spanair as EC-420 on 12 April 1990 and re-registered EC-FVV on 1 July. Back to GPA on 12 April 1991 it was then leased to ALM on 24 May. One Engine

Left and Below Left: Often the lease of an MD-80 airliner involves a lease turned from one Air Force restored to another. This is illustrated by these two examples taken from Europe (Austria and Switzerland) for service with Dinar Lineas Aereas of Argentina, a small domestic operator also flying regional flights to Chile, Uruguay, Paraguay etc.

MD-83 (DE-LMD (Ex) (Cross Air) was leased to Austrian Airlines on 28 March. It departed Vienna on 14 December 1996 for a similar lease commencing on 25 April 1997.

MD-87 (DM-TNW (Ex) (Air France) delivered to Finland on 9 September 1988 also leased to [illegible]

Aerolineas Argentina

[illegible]

[illegible]

[illegible]

Aero Lloyd

[illegible]

[illegible]

AEROMEXICO

MAIN PICTURE: Seen at Miami in 1996, AMO MD-82 EI-BTX was completed January 1988 as N9984J for Texas Air Corp but not taken up. It instead went to Aeromexico on 9 October 1988. AMO (Aeronaves de Mexico) is one of the country's two national airlines and is based at Mexico City. It is interesting to note that, although the earlier DC-9s carried 'XA' Mexican registrations, the MD-80s series carries either US or Irish registrations. By 1991 the combined DC-9/MD-80 fleet was approaching two and a half million landings in Aeromexico service. *Chris Flegg*

INSET: *Baja California Norte*, MD-82 N1981L seen at Miami during 1996. During December 1989, Aeromexico took delivery of the first two of 10 MD-88s, the most advanced of the MD-80 series. By July 1997 the airline was operating 11 MD-82s six MD-83s, two MD-87s and 19 MD-88s. The Mexican carrier uses the MD-88s on domestic routes and on international services to the USA, in a spacious two-class configuration with 20 first class passengers and 115 in economy. *Chris Flegg*

Air Liberté

Air Liberté was a French carrier operating charter passenger services to both overseas and Mediterranean holiday resorts. By July 1992 the airline was flying six MD-80s. It commenced operations on April 1988 with a single MD-81 leased from the GPA Group. Here is MD-81 F-GHRD which was registered on February 1991 and delivered on 29 March. It is shown at Palma, Majorca, in June 1990. (Jet Photos)

Air Jamaica

Air Jamaica was established as the national flag carrier late in 1968, commencing operations on 1 April 1969 with two new DC-8 airliners. A look at the MD-83 specification by aircraft that Aaron Worldwide Aviation Services, one of the world's top aircraft leasing companies and based in Australia, received a total of MD-83s (msn's 53282 to 53285). Delivered to AWAS as new Air Jamaica Kingston, 1995

ALM Antillean Airlines

Boeing. In October 1987 ALM Antillean Airlines ordered two MD-83s and two DC-9-30s, followed by a third leased from Continental in April 1988. Aimed at an early retirement scheme of DC-9-32 Aircraft, which was completed on 27 May 1988 (to the public that was never up). It was delivered to ALM on 13 October 1987.

AIRTOURS

Above: [illegible] Striding steadily [illegible] over the Sierra Nevada mountains near Long Beach shows MD-83 N580A at the end of 1990. It was completed in September to become one of eight MD-83s operated by Airtours, a Manchester-based UK passenger charter carrier. Operations started in 1991 with five airliners leased from [illegible] Aerospace. N580A being leased as G-TIPT on 15 March 1991 and named *Sir Garfield* [illegible].

Below: Line Excellent publicity photo taken at Manchester airport showing the Airtours fleet of five MD-83s plus the operator's personnel. The airliners are G-DCAC, G-HCBP, G-COES, G-TIPT and G-DEVR. A range of up to 2,500 miles (4,023 km) was quoted carrying 167 passengers and seven crew. The current record operating the type is 1986. [illegible]

ALASKA AIRLINES

Above: Seattle-based Alaska Airlines became the first operator of the new extended-range MD-83 when it signed for one aircraft in March 1984. By July 1987 the airline had nine MD-83s and 14 MD-80s. The first commercial service was operated on 20 February 1985 on the popular Anchorage–Seattle route. This is MD-83 N943AS seen landing at San Jose, California on 13 September 1986. [illegible]

Below: Alaska Airlines took over Jet America, a Long Beach based MD-83 operator, in November 1987. The current MD-80 Alaska fleet seats 130 passengers in a two-class configuration which includes first class. Shown is MD-83 N941AS which was delivered to Alaska on 31 March. It is shown at San Francisco on 27 June 1986. [illegible]

American Airlines

[illegible] American Airlines was operating 260 MD 80s and 5 MD 90s to extensive route systems across the USA. The latter variety was placed in September 1995 on a seven-year agreement with MDC. Today American Airlines operates the largest airline fleet of any single type in the world, outside the Commonwealth of Independent States (CIS). There was a time when Delta's combination of the MD 88 series had been exercised but Boeing's received a staggering 338 Internet orders. The MD 83 N280AA completed in July 1992 and delivered on 29 August. By December 1996 the airliner had flown 41,802 hours and made 23,858 landings.

Alitalia

Delivery MD 82 I-DAVK *Bisenzio*, designated 'Super 80' on the engine and the fuselage in front of the centred airline titles. The aircraft was completed on 8 May 1987 and delivered on 21 June. Alitalia has been a notable DC-9 customer since it acquired the first of its DC-9-32s on 8 August 1967. Today the fleet includes no less than 90 MD 80s fitted out to carry 155 passengers in dual class or 172 in single-class [illegible].

Alisarda

Delivery MD 82 I-[illegible] was leased on 10 March 1993, with the sole aim of developing tourist services to Costa Smeralda in Sardinia. The leasing Italian private airline was renamed Meridiana in September 1991. The fleet, which included six MD 82s, was supplemented from Nairobi, the first having entered use in 1994. The airline now operates 170-seat aircraft services to a number of scheduled as well as charter destinations and flights were begun to Italy, Switzerland, France and Germany, commencing in May 1996 after a period in an all-out-and-charter operator to Sardinia. The first two airliners were flown from Long Beach with Swissair registrations, these being HB IKK on 19 September 1989 and HB IKL on 27 September. These airliners were quickly registered I-SMILE and I-SMILM with Meridiana. Delivered I-SMILP delivered on 31 August 1993 and was in [illegible] in 1996 [illegible]

AOM-MINERVE SA

Minerve, The French government decided to make over-the-counter sales of Airbus A300 and A310 aircraft subject to the Open Skies Agreement. Air France and Air Inter Europe already established Orly Airport Quest (West) terminal in Paris, and the AOM French Airlines group was to make use of this and less congested Orly South (South) terminal, used mainly by non-French carriers. AOM relished 'striking out' the restriction to French travel to stay at Orly West'. MD-83 F-GRMB is seen at Orly with its colourful passenger [illegible]

BELOW: MD-83 F-GAOMD completed 24 June 1988 has a typically complicated history. It was delivered to Minerve on 28 July, leased to Jet Absent the same day, returned to Minerve on 1 March 1989 and to AOM on merger the same day. By 1990 AOM French Airlines was operating five MD-83s with a further three more on order. [illegible]

AUSTRAL

In 1985 Austral Lineas Aereas, a privately owned Argentinian airline operating a network of scheduled passenger services radiating from Buenos Aires [illegible] with 139 passenger airliners. Here is MD-83 LV-WGN, which was completed in August 1990 and delivered as N967MD to Tish Aerospace prior to lease to Austral on 29 September. It was re-registered LV-WGN in September 1990. [illegible]

AUSTRIAN AIRLINES

Before Austrian Airlines commenced services with the MD-80 on 16 October 1990, and with MD-87 on 12 December 1992. By May 1995 Austrian Airlines was operating a galaxy of the MD-80 series including five MD-81s, four MD-82s and five MD-87s. Shown is OE-LMB [illegible] completed as an MD-81 on 16 September 1985 and delivered on 30 October. In March 1990 it was converted to MD-82 configuration. In this photo MD-81 is modified on the former aircraft. [illegible]

AVIACO

[illegible] Aviaco (Aviación y Comercio) of Madrid, Spain, was formed in 1948 to operate services by Bilbao businessmen. Today the airline operates services throughout Spain and the Balearic and Canary Islands on behalf of Iberia. The 4 passenger MD-88 airliners of which 11 are currently operated were the first of the Long Beach model to operate in Europe.

During 1996 the airline unveiled a modified colour scheme by adding orange stripes over the chest line. These were to celebrate the 1996 Vuelta – the grand tour of Spain bicycle race. The bicycle colour scheme was apparent on at least one Aviaco MD-88 airliners. EC EOI, EC FOZ and EC CPJ *Rio de Vigo* [illegible]

AVIANCA

[illegible] Lear *Ciudad de Barranquilla* on the large hangar at Shannon during an overhaul. DC-8 BW was leased from GPA, after completion in June 1991 it was stored at Mojave, California, prior to lease to Aviaco on 12 February 1992 during the last four months of 1996. Aviaco had five MD-81 airliners processed through the Shannon Aerospace hangar for 18,000 flight hour checks. Shannon [illegible]

BALAIR

[illegible]

BWIA INTERNATIONAL

[illegible] BWIA [illegible]

BLUE SCANDINAVIA

[illegible] Long Beach [illegible] operated four MD-83s and a single MD-87. More [illegible]

CANAFRICA

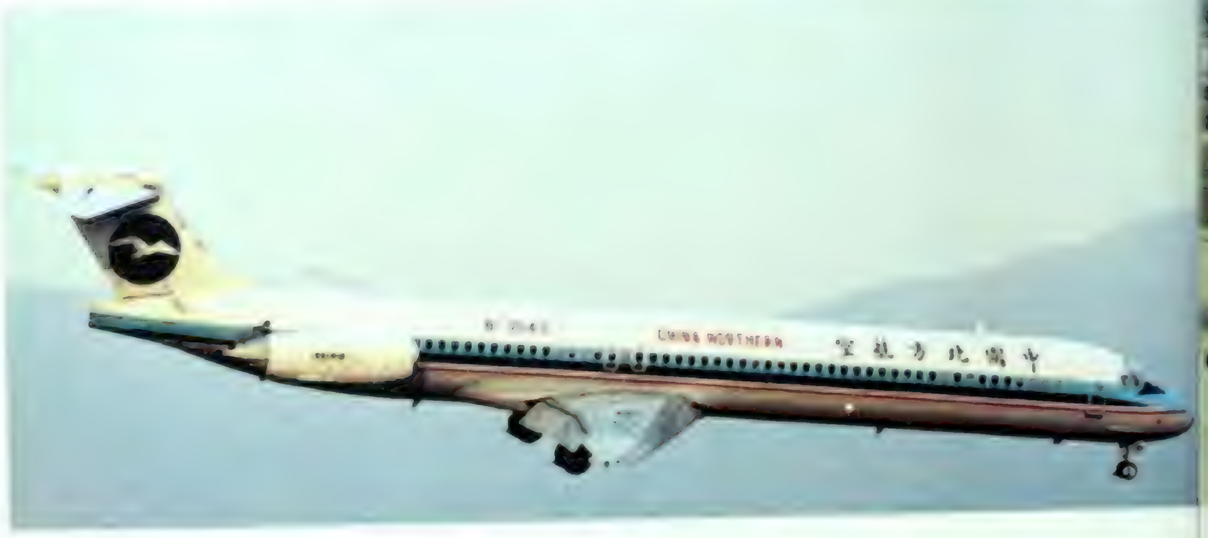
Ltd Canadian Transport Agency was formed in 1985 with two 165 passenger MD-83s on long-term dry-lease from GPA Group and provided inclusive tour services to Europe. The airline was maintained by Swissair at Zurich. In June 1988 the sole Aircraft was adapted. Operated as MD-83 EC-EEO completed 28 March 1987 and delivered via LAPA to Canadian on 28 April that year. MSN

CENTENNIAL AIRLINES

MD-83 Centennial Airlines based in Palma Majorca, operated up to six full service QEA-owned Novembers 1990 when the company ceased operations. Two Long Beach-built Gemini Pratt-and-Whitney Tennessee and two from Dublin for lease. EC-EIX first flew at Long Beach on 2 September 1986 and was registered SE-DHR for GPA for lease to Transwede. It went on sub-lease to Centennial as EC-400 on 29 March 1993, then was re-registered EC-EIX in June

CHINA EASTERN AIRLINES

Airlines Right: Established on 25 June 1988, China Eastern Airlines based in Shanghai operates scheduled regional and domestic passenger services as well as cargo operations. Its large international fleet includes 15 Long Beach-built MD- and 6 has-to-order nine MD-90-30 airliners. Departed on final approach to Hong Kong Airport during November 1996 is B-2102 completed 29 November 1982 as delivered to the airline on 1 May 1988.



CHINA NORTHERN AIRLINES

(CNA) China Northern Airlines, based at Dongta Airport, Liaoning, was established in 1990 and today is one of the largest airlines operating in China. Its scheduled, charter, regional and domestic passenger services cover a network of 120 cities to Japan, Korea and South East Asia. Its fleet of MD-80 and MD-90 airliners includes 18 NAIC (China-built MD-82s. On approach to Hong Kong during November 1996 is B-2145, completed by Shanghai Aviation Industrial Corporation in August 1992 and purchased by China Northern Airlines on October 1991.

CONTINENTAL AIRLINES

By 1990 Continental is one of the largest US airlines, with over [illegible] scheduled passenger services covering over 80 destinations in [illegible] international destinations. In June 1993 the airline placed [illegible] for the type MD-83, the records revealing this title was N2822J to 1400 in 1988, this [illegible] originally for Texas Air Corporation but going to Continental by [illegible] 1986. It is still in service today. N627AC, an MD-82, [illegible] at Miami [illegible] March 1987. Ex Air California, N627AC transferred to Continental on 12 November 1986 on lease and is still in service over 10 years later.

Crossair

Above: Until 1997, Established in 1975, the Swiss regional and domestic airline Crossair used its base at Melbourne Rada with a hub at Zagreb. Adding to its varied fleet are nine MD-82 and seven MD-83 airliners. The MD-83, HB-IUV, was leased from Orient. It was completed on 19 February 1987 and delivered to Swissair and named Dietenhofen on 18 March. Crossair

Above: Dida's hangar seen at Shannon Aerospace showing other aircraft undergoing maintenance checks are Boeing 757 D-ABNX of Condor, Boeing 737-300 CTC of Croatia Airlines, a Crossair MD-80 and a Sun Air DC-9 from South Africa. The airport at Shannon has become a major aviation centre and is the greatest the largest industrial site in Ireland. Shannon Aerospace

Below Left: McDonald teamed with the Swissair subsidiary Crossair and Swissair operator Hotelplan to provide the unique livery on MD-83 HB-IUH. Crossair commenced operating the airliner exclusively for Hotelplan on 29 March 1998, on charters from Zurich and Geneva to Mediterranean resorts. Passengers flying aboard M-Plane, as it was called, were even offered many McDonald hamburgers as in-flight meals. Crossair

Delta Air Lines

Originally built as an MD-82, N908DL was completed on 29 January 1991 and delivered to Delta on 1 April. On 15 June it was bought by the Chrysler Capital Corp and leased to Delta on the same day. During August 1993 it was one of a number of the MD-82s that received Long Blue Stripe modifications by MD-80 Configuration in Dallas. See Airliner Gallery, Issue 10 for a full story of Delta's MD-80s.

Finnair

By late October 1998, Finnair, a new Family Member and national flagship Airline for Finland, had received Finnish Aviation Art and Award, by unanimous Council decision. Finnair is the Helsinki, Finland, Capital, Financial and Political National Airport. MD-87 (DC-9-87) is one of Finnair's favourite aircraft. (Courtesy Finnair, who kindly let us have it in late March 1999.)

Finnair

The British Caravan, the national airline of Finland, in July 1997 was still operating all MD-82s, 10 MD-83s and three MD-87s, covering an extensive network of scheduled services from Helsinki. It was the launch customer for the MD-90 and MD-87 when it ordered seven in February and December 1989 respectively. Finnair's OH-LMR, the second MD-87, arrived in Kuusamo in December 1987 and delivered in January 1988.

German Wings

Jet Alsace

Heliopolis

Linea Aeropostal Venezolana

Iberia

Japan Air System

Lineas Aereas Canarias

[illegible] Ltd (LAC) is the main domestic carrier in the Canary Islands. The [illegible] fleet of four MD-83s – EC-EEV *Isla de Lanzarote* – delivered in 1985. [illegible] of the four aircraft are now flying on [illegible] routes. The [illegible] used on [illegible] and [illegible] to the Canaries from [illegible] in Europe and North Africa, as well as on [illegible] services. By 1992 the fleet of MD-80/90 [illegible] to the GPA Group.

Midway Airlines

[illegible] Robert Christopher Maloney Jr. [illegible] founded Midway Airlines on 1 November 1979 [illegible] as a [illegible] operating [illegible] the airline's [illegible] to serve some [illegible] destinations in the USA and Canada plus the US Virgin Islands and the Bahamas. Service [illegible] with a fleet of 19 DC-9-10s, two DC-9-30s, three MD-82s and four MD-83s, the last three types seating 150 passengers. All aircraft [illegible] with a two-class [illegible] layout.

Korean Air Lines

[illegible] Korean Air Lines [illegible] Korean Air Lines was established on 26 June 1962 and [illegible] its [illegible] and Europe. It [illegible] Tokyo in February 1969. Korean Air Lines was [illegible] in March 1988 to [illegible] its [illegible] with [illegible] services. [illegible] Korean Air [illegible] 31 MD-80s and [illegible] MD-90s. [illegible] Korean Air [illegible] South Korea.

New York Air

Motto: *New York Air* was created a fleet of seventeen MD-80s scheduled for September 1987 on low fare scheduled services out of New York's La Guardia and Newark airports. In February 1988, the airline was integrated into Continental and the airliners repainted and marked. Names here is MD-82 N810NY, which was scheduled for 1 April 1987 to Stockholm for Air Conference, it went to New York Air on August 28th, 1987.

Northwest Airlines

The Northwest Airlines acquired a large fleet of Long Beach-built jet airliners from its new Republic on 12 August 1986, making Northwest one of the world's largest airlines. By July 1987, it was still operating eight DC-10s and MD-82s configured for mixed passenger/freight use. Delivered at Miami as DC-9 as MD-82 N810NC, named *Lord Selkirk of Red River* on 4 March 1987 as N1008L for Republic Airlines.

Nigeria Air

Air Nigeria is a private 2 Nigerian-owned airline, named after Air Liberia, worked from 30 [illegible] in July 1986, including DC-10-30 as DC-10-30CF, DC-10-30 and 2 DC-10-30CF. Used in the former DC-10-30CF, which was converted from DC-10-30 in 1988 to DC-10-30 for Irish Aerospace. Unusually, the national registration letters 'TN' for Tamaulipas were used only on the MD-80 fleet.

Oasis International Airlines

Centro Rojo: Oasis is a Spanish charter carrier based at Madrid operating in Europe during the summer holiday months, then during the rest of the year the airliners are operated by Mexicana-based Aeroservicios. Oasis operated the MD-83 starting with a Malaga Manufacturer Malaga named registers 27 May 1988. By July 1988 the airline was operating a single MD-83 and two MD-82s, the latter configured for 165 passengers, flying transatlantic charter network from Madrid and Malaga. Delivered as MD-83 EC-EOM, completed on 14 March 1989 and delivered as EC-260 to Irish Aerospace.

Pacific Southwest Airlines

Route: PSA, a major US regional airline, took delivery of its first MD-83 on 18 November 1986. The fleet grew rapidly and it eventually numbered 18 MD-83s and 11 MD-82s (both configured for 150 passengers). On 9 April 1988 the airline was absorbed by US Air. Here is N670PS which is completed on 30 May 1989 and was delivered on 30 June. It was named *The State of San Jose* and registered N408US.

Onur Air

[illegible]

Paramount Airways

[illegible]

Private Jet Expeditions Inc

[illegible]

RENO AIR

• For Reno Air, a publicly [illegible] passenger service formed in 1992, the [illegible] the MD-87 and MD-88, and [illegible] Operated a MD-80 SERVICE, which [illegible] to SERVICE. Reno Air was [illegible] and February 1999. [illegible]

SCANDINAVIAN AIRLINES SYSTEM

Early Boeing 720s SAS celebrated its 50th anniversary [illegible] the MD-87, SE-DIP Magnus Viking, [illegible] approximately, [illegible] 8 Nov 82, on 3 October 1999 and was [illegible] to MD-87, as SE-DOY Mammut OTARED with SAS [illegible] 1999. It was [illegible] by Otto Lessing International Company Limited on 8 November 1999 and leased to SAS the same day. [illegible]

[illegible] SAS is the [illegible] Denmark, Norway and Sweden. It has been a prime operator of the Long Beach DC-9s [illegible] when it introduced the earlier DC-9s to [illegible]. The first [illegible] SAS [illegible] Norway, SP Sweden. Soon [illegible] Viking MD-81 LN-RMI [illegible] 1980 and delivered on 13 March. [illegible]

[illegible] Corporate SAS [illegible] fleet of MD-81s, 21 MD-82s, two MD-83s and 18 MD-87s. Besides operating the MD-80 airliner, [illegible] operates the MD-90 [illegible] Boeing 737s, which [illegible] for delivery [illegible] and delivered [illegible]

SPAN AIR

Spanair, the March 1993 [illegible] operating a fleet of 38 MD-80 series aircraft comprising one MD-82, 15 MD-83s and 16 MD-87s. At least nine were leased from GPA, one from AOM and one from Polaris. All were configured in an all-economy class for IAS passenger charter operations, employed on the extensive charter programme which ensures full exploitation of Spain's tourist facilities. Seen here is EC-FXV (msn 49618) departing Palma de Mallorca on 4 June 1990 from Palma de Mallorca on its home-registered base at Bilbao. MD-83 EC-FXV [illegible] departing for Barcelona from Palma de Mallorca on [illegible]

SWISSAIR

[illegible] joint corporation between MD Megacarriers is well known and was originally formed on the airline itself. Shown is Swissair MD-80 HB-IND soon [illegible] March to 1995. In addition to the words 'servus Wien' it also has 'Joint Hub by AUSTRIAN SWISSAIR' inscribed on the lower parts of the forward fuselage. HB-IND first flew on 6 October 1989 and was delivered to Swissair [illegible] on 26 October. [illegible]

SUN JET INTERNATIONAL

Above: Based at St Petersburg, Florida, since it was established in 1993 by its parent organisation, Sun Jet Holidays Corporation, today Sun Jet operates a mixed fleet of Long Beach built airliners — one MD-81s (built ex Hawaiian) and a single DC-10-40 — ex-D-ALLD. Photographed at Orlando, Florida on 25 April 1997 is DC-10-40 N840SJ which has been leased since 15 July 1993. It is ex-Hawaiian 340MA *Beautiful Hilo* which was delivered on 20 July 1981 after completion at Long Beach on 21 April. *George W. Pimentel*

SUNWAY

Below: TC-INC [illegible] at Düsseldorf, Germany during 1995, in a multi-registered Sunways Interair Haverfield MD-83. It is one of four of Sunways MD-83 airliners, all on lease from GPA. On leasing the factory in October 1987 it was registered EI-CKM, then successively D-ALLW, XA-RPH, EC-FIF, EC-520 and now currently TC-INC. [illegible]

TRANSWEDE

Ansett ILFU, Transwede MD-83 SE-DPU, was here at Gatwick on 1991 Jan but had a ...Acquired cancer. Completed on 20 October 1990, it was delivered as SAA RTK to Inter Aerospace on 31 December 1990. Many leases followed including one to Compass Airlines as VH-UNI on 3 August 1992. After re-possession it went on lease to Transwede on 29 May 1991 and then to Spanair as EC-692 on 12 March 1992, it was re-registered EC-FXA in June 1991. *Ian Duggan*

CENTRE LEFT: Formed early in 1986, Transwede placed an order for two MD-83s in July 1987. The first was SE-DBRA, which was delivered on 6 August 1988. It was completed on 12 January 1987 and initially registered N287MD to Long Beach. It was leased by Transwede to Norway Airlines and then to Veteran in 1991-98 receiving SX-BAW, it returned to Sweden on 2 January 1998. *Ian Duggan*

TUR EUROPEAN AIRWAYS

BELOW LEFT: Known locally as Avrupa Hava Yollari, TUR was a Turkish charter carrier based at Istanbul, operating exclusive tour flights to destinations in Europe. When it started operations on April 1990 it had included two MD-81 airliners on lease from Irish Aerospace Limited. Both were returned after nine by January 1991 when the company ceased operations. The two MD-83s were TC-THE, (shown here) delivered on 30 May 1991, and TC-RTU, delivered on 16 April 1991. *Ian Duggan*

TRANS WORLD AIRLINES

ABOVE: By March 1997 TWA was listed as operating 21 MD-83s and 10 MD-82 airliners plus a mixed fleet of 58 earlier DC-9 models. Its first of the MD-80 series, MD-82 N901TW was delivered on 18 April 1983. The 142 passenger airliners were 12 first class and 130 economy class passengers and operates a large domestic network serving both the Atlantic and Pacific seaboards on a hub and spoke system out of St Louis, Missouri, which is also the airlines' corporate headquarters. *Ian Duggan*

BELOW: On 30 September 1974 TWA officially launched a new colour scheme which replaced the earlier traditional 'two-tone blue' scheme. Then, during 1996 TWA introduced a more futuristic colour scheme on its large order that featured the new colours in MD-83 N950MD on position for departure from Runway 01R at San Francisco on 22 February 1997. *Harold Clarke*

Unifly Express

[illegible] in 1980 as a [illegible] carrier, with its fleet consisting [illegible] MD-8[illegible] [illegible] 1979, Unifly Express started [illegible] and contract [illegible] and [illegible] holiday [illegible] Europe and the Mediterranean, even operating as far as the Canary Islands. The four MD-80 se[ries] airliners were MD-82s EI-BTX, EI-BTY, and MD-83s EI-BTU and EI-BTV. By March 1990 the four airliners had been returned to the GPA Group, and despite the purchase of the Italian regional airline Alisarda Spa, no further airliners were leased. Illustrated is MD-83 EI-BTU. *Chris Doggett*

Venus Airlines

Above: Based in Athens, Venus was established during 1993. It operates one MD-83 but in 1994 had two MD-87s and two MD-82s. One of these went by June 1996, the other by February 1997. The two MD-82s were SX-BBV and SX-BBW, the former shown on approach to Athens airport in 1994. *Chris Doggett*

US Air

Inset Right: *The Smile of San Diego* [illegible] US Air [illegible] at Fort Lauderdale, Florida during 1998. Registered MD-81 [illegible] completed [illegible] 17 February 1982 as N[illegible] for PSA. It [illegible] October [illegible] the airline merger on 9 April 1988. *Chris Doggett*

US Air

Live. Subsidiary of [illegible] airline about 300 [illegible] MD-80 [illegible] MD-88 [illegible] MD-87 [illegible] MD-90 [illegible]

Zas Aviation Service

Est Live. ZAS [illegible] Air Ambulance [illegible] and was formed in late 1981 [illegible] commercial passenger [illegible] September 1982. In March 1988 a single MD-82 was [illegible] SU-DAR [illegible]. This was followed by a single MD-82 [illegible] MD-83s and three MD-87s all fitted out for VIP [illegible] single-class layout. A scheduled [illegible] name was added to [illegible] ZAS [illegible] operations on 28 October 1988. [illegible]

Below: ZAS MD-82 YU-ANG [illegible] 10 May 1981 and leased from Inex Adria [illegible] January 1988 to 1 May 1988. [illegible]

7 Accidents & Incidents

May 1980: MD-81 N980DC Edwards AFB, CA, USA
Completed at Long Beach on 18 October 1979 this was the prototype MD-80 which first flew on that date. Trials proceeded smoothly with only the odd problem. However, during May 1980 N980DC was damaged in a heavy landing at Edwards Air Force Base, California whilst taking part in a new Federal Aviation Administration (FAA) test requirement to ascertain the minimum distance required from a height of 50ft (15m) to touchdown. There were no casualties among the flight test crew and the aircraft was repairable. However, N980DC was withdrawn from further use and placed in long term storage at Cimarron County Airport, Stormie, Texas. It was powered by two JT8D-217 turbofan engines and up to retirement had flown 3,065 hours and accomplished 6,558 landings.

19 June 1980: MD-81 N1002G Yuma, AZ, USA
Completed at Long Beach on 26 June 1979 this was the second Series 80 airliner and made its first flight on 6 December 1979. Initially allocated the registration HB-INB with Swissair, it was not taken up and was finally registered N1002G and operated by the company. On 19 June 1980 it was damaged in a landing accident at Yuma, Arizona, during simulated hydraulic failure trials. It was repairable but the boom of a crane being used to move the airliner from the runway broke off and fell across the fuselage, causing additional damage and rendering repair uneconomic. It was powered by two JT8D-209 turbofan engines and had completed 373 flying hours and accomplished 468 landings.

1 December 1981: MD-82 YU-ANA Corsica
Completed at Long Beach on 15 May 1981, this MD-82 was delivered on 11 August to the airline. On 1 December 1981 it crashed into Mont St Pietro, 25 miles (40km) south east of Ajaccio, Corsica. There were 180 fatalities and no survivors. The airliner to that date had completed 663 flying hours and accomplished 420 landings. YU-ANA was powered by two JT8D-217 turbofan engines.

16 August 1987: MD-82 N312RC Detroit, IL, USA
Completed at Long Beach on 31 October 1981, it became N1406E for Republic Airlines on 9 December 1982. Following a merger with Northwest Airlines on 1 October 1986 the fleet number became 1406. On 16 August 1987 it crashed on take-off from Detroit Airport with 154 fatalities and only three survivors. Powered by JT8D-217 engines the airliner had completed 24,000 flying hours and accomplished 8,971 landings.

On taking off Flight 255, the twin-jet airliner took off from Runway 3 (Now Detroit Metropolitan Wayne County Airport) instead of Runway 4 (Now Airport), one segment of a domestic service originating at Saginaw, Michigan, with an ultimate destination of John Wayne Airport, Orange County in southern California. Only 19 seconds after becoming airborne, and while at an approximate height of 50ft (15m) above the ground, the aircraft struck, with its port (left) wing, a lamp standard located about ¼ mile (0.4km) beyond the end of the runway.

With its undercarriage still in the process of retracting, the MD-82 then clipped other lamp standards and the roof of a building and rolled to the left in excess of 90° before it hit the ground, disintegrated and burst into flames, scattering wreckage along a road, and under a railroad and two highway overpasses. 156 people were killed in the disaster, including the aircraft's six crew members and two occupants of vehicles hit by the crashing airliner. The sole surviving passenger was a four year-old girl travelling with her parents and brother. She suffered severe burns, a fractured skull and other injury-related trauma. Five other people on the ground were also injured, one seriously, and numerous vehicles, those on the road and the one parked in a rental car lot, destroyed.

Examination of the debris disclosed no evidence of a malfunction in the airliner's engines, flight controls or systems that could have directly contributed to the accident. One significant find was made, however: its flaps and leading-edge slats were confirmed to be retracted at the time of the crash. This was further corroborated by the position of the cockpit flap-slat handle and by the digital flight data recorder (DFDR) read-out, which includes these items among its transcribed parameters.

Playback of the cockpit voice recorder (CVR) tape also revealed that the two-man flight crew neither called for nor carried out the taxi checklist, on which the extension of the flaps and slats is the first item. In accordance with Northwest Airline procedures, the first officer usually set them after the start of the taxi, but at around the time that this should have been done, the co-pilot of N312RC was receiving information regarding a change of take-off runway. There was speculation that by the time he finished copying this automatic terminal information service (ATIS) message, the MD-82 had progressed beyond the point where the extension would normally be completed, which may have misled him to believe that the task had been accomplished.

The stated policy of the airline is that the captain is supposed to initiate the check list routine. The captain of Flight 255 did not ask for the after-start, taxi or before-take-off checks, relegating this responsibility to his first officer. These and other factors, including confusion over the location of a particular taxi way despite the fact that the pilot had flown into this airport many times, led the US National Transportation Safety Board (NTSB) to conclude in its investigative report that the conduct of the crew did not conform to air carrier standards, even though both pilots had gained a reputation for competence and professionalism from their peers. The omission of the taxi check list was, in fact, regarded by the NTSB as the primary cause of the disaster.

The MD-82 is equipped with a sophisticated control aural warning system (CAWS), which has an important component designed to recognise the conditions that could precipitate a stall, such as an improper flap-slat configuration, and is activated by movement of the thrust levers. No such aural warning (consisting of a voice stating 'flaps' and/or 'slats') was transcribed by the cockpit voice recorder (CVR), which the NTSB attributed to a loss of electrical power to the system. This may have resulted from intentional action by the crew or maintenance personnel, from a transient overload, or because the circuit breaker did not allow the current to flow to the control aural warning system (CAWS) power supply and did not annunciate the condition by tripping. The power loss was considered the principal contributing factor in the crash.

Above: Passengers in this MD-81 airliner crash on 27 December 1991, had a far better chance of survival than they would have had 30 years earlier. There was no fire in the SAS *Dane Viking* crash, even though the airliner broke into three and it was loaded with fuel. *PA News Photo Library*

The absence of extended flaps and slats would have severely limited the climb capability and increased the airliner's stalling speed. This accounted for its relatively long take-off ground run and the fact that N312RC assumed a higher than-normal pitch angle after becoming airborne while gaining little altitude. The stick-shaker stall-warning system was heard on the cockpit voice recorder (CVR) tape to activate less than a second after lift-off. Once in the air the airliner began rocking laterally, which the crew attempted to control by deploying the spoilers. The 'Dutch roll' motions and corrective action further decreased the performance of the MD-82.

A section of the left (port) outer wing some 18ft (15.5m) long was torn off in the initial impact with the lamp standard, rupturing fuel tanks. Escaping fuel was then ingested into the

airliner's No 1 power plant and ignited, this explaining the in-flight fire reported by some witnesses.

The accident occurred at twilight (20:43hrs), the weather at the time was fair, with a high overcast and scattered clouds down to 2,500ft (750m), a visibility of around 5 miles (10km) and a 12 knot wind out of the west. Wind shear advisories had been broadcast shortly before the departure of Flight 255 although there was no evidence from available information, including the digital flight data recorder (DFDR) read out, that such a condition in any way contributed to the crash. Nevertheless, the alert may have influenced the actions of the crew even to the point of reducing their ability to escape from the stall. The captain, who was flying the aircraft, apparently increased its pitch angle after the stall warning, showing he suspected an encounter with wind shear; stall recovery procedures normally involve lowering the nose and extending the flaps which in this case would probably have prevented the disaster.

Subsequently, all operators of the MD-80 series incorporated a check-list procedure to ensure that the control aural warning system (CAWS) was functional prior to take off. The US National Transportation Safety Board also recommended that the system's tail light be modified to compensate for its inability to annunciate in the event of a power loss.

In May 1991 a US federal court rejected Northwest Airlines' contention that McDonnell Douglas share responsibility for the accident, ruling that the carrier was liable for all damages resulting therefrom.

12 June 1988: MD-81 N1003G **Posadas, Argentina**

Completed at Long Beach on 16 April 1981, it was delivered as [illegible] to Austral Lineas Aereas at Buenos Aires, Argentina [illegible] 1981. On 12 June 1988 N1003G crashed on final approach at Posadas airport in Argentina during bad weather [illegible] fatalities. The airliner was powered by two JT8D-[illegible] engines and had completed 19,280 flying [illegible] accomplished 13,929 landings.

Above: By the end of 1997 American Airlines had 260 MD-80 airliners listed in its large fleet, these included 210 MD-82s and 26 MD-83s. One of them, MD-82 N275AA seen in landing configuration during October 1996, was damaged on landing at Cleveland Hopkins International Airport, Ohio on 5 March 1997. (TAP)

27 December 1991: MD-81 OY-KHO Stockholm, Sweden

MD-81 *Dana Viking* was sixth of a batch of 12 ordered by SAS with deliveries late in 1990 and early 1991. OY-KHO first flew at Long Beach on 29 March 1991 and was delivered on 10 April. It was powered by two JT8D-217 turbofan engines. On Friday 27 December 1991 it was operating SAS flight SK751 out of Arlanda, Stockholm to Bromma, Copenhagen with 123 passengers and six crew. Due to below freezing temperatures the flight had been delayed some 18 minutes whilst ice was removed from the airliner's wings, so it was 7:48am when the MD-81 finally took off from Arlanda. Only three minutes after take-off Captain Stefan Rasmussen reported losing power on both engines at an altitude of 1,800ft (549m). In a brilliant 'controlled crash' landing (see photograph on page 1051 in which the pilot skewed the airliner's flight by brushing the tops of fir trees the Danish pilot saved the lives of the 129 occupants. Total flying hours were 1,608 with 1,272 landings.

26 October 1993 MD-82 B-2103 Fuzhou, PRC

Completed at Long Beach on 8 August 1985, on 7 October 1985 the airplane was registered as B-2103 to the Civil Aviation Administration (CAA) of China and delivered on that date. On 1 May 1988 it was transferred to China Eastern Airlines based at Hongqiao International Airport, Shanghai and on 26 October 1993 the airliner was damaged beyond repair after over-running the runway at Fuzhou, Fujian Province, PRC. There were two fatalities and 79 survivors. The airliner was powered by two JT8D-217 turbofan engines and had completed 18,718 flying hours and accomplished 11,942 landings.

November 1993: MD-82 B-28003 Taiwan

[illegible]pleted at Long Beach during August 1991, it was delivered [illegible] B-28003 to Far Eastern Air Transport at Taipei, Taiwan, on [illegible] October 1991. On 30 November 1993 the MD-82 pilot [illegible]perienced engine difficulties immediately after take off from [illegible]ashsiung, Taiwan. He returned to the airport and made a [illegible]ry hard landing. The undercarriage collapsed and the left [illegible]wn wing separated and the airliner hit a small building and [illegible]as severely damaged. Happily, there were only nine minor [illegible]juries. The airliner was powered by two JT8D-217 turbofan [illegible]gines and had completed 4,529 hours and accomplished [illegible]195 landings.

4 November 1993: MD-87 SE-DIB Denmark

[illegible]elivered as SE-DIB *Varun Viking* to SAS in October 1988, on [illegible]4 November 1993 a fire broke out in the lavatory after landing [illegible]t Copenhagen resulting in major damage to the airliner [illegible]though, fortunately, no injuries. Repaired, by the end of [illegible]ecember 1996 this airliner had flown 18,673 hours and [illegible]ccomplished 12,766 landings. It is still in service with SAS and [illegible]owered by two JT8D-217 turbofan engines.

3 December 1993: MD-82 B-2141 Urumqui, PRC

[illegible]onstructed in China by the Shanghai Industrial Corporation, [illegible] was bought by China Northern Airlines on 31 December [illegible]991. On 13 December 1993 it crash-landed in a field and [illegible]aught fire while on final approach to Urumqui airport in fog. [illegible]There were 12 fatalities and 90 survivors. The airliner was [illegible]owered by two JT8D-217 turbofan engines and had flown [illegible],002 hours and accomplished 2,694 landings.

March 1994: MD-82 N18835 La Guardia, NYC, USA

On 2 March 1994 the airliner ran off the end of the runway during an aborted take-off at New York, La Guardia, during a [illegible]owstorm, coming to rest on a dike and a tidal mud flat. Some [illegible]9 seconds had elapsed between the time that N18835 actually [illegible]celerated through 60 knots indicated air speed (the first mark [illegible]n the airspeed indicator) and the start of the rejected take off.

The flight data recorder on recovery confirmed that the pitot head system heat had not been selected 'on' by the flight [illegible]ew. A build up of snow and/or ice in the pitot static system [illegible]ubes and ports resulted in erroneous airspeed readings during [illegible]he attempted take off. Substantial deviation from check list [illegible]rocedures were recorded. There were 80 minor injuries and 86 [illegible]uninjured.

The US National Transport Safety Board gave the possible [illegible]ause of the accident to the failure of the flight crew to comply [illegible]ith check list procedures to turn on an operable pitot static [illegible]eat system, resulting in ice and/or snow blockage of the pitot [illegible]ubes that produced erroneous airspeed indications, and the [illegible]ight crew's untimely response to anomalous airspeed indica[illegible]ons with the consequent rejections of take off at an actual [illegible]peed of 5 knots above VI. (*NTSB Report AAR-95/01*).

N18835 was seen in a hangar at La Guardia in the process [illegible]f being repaired returned to flight status with Continental Airlines and by the end of December 1996 had flown 30,887 hours and accomplished 14,537 landings. It was powered by two JT8D-217 turbofan engines.

6 September 1994: MD-83 SE-DPI Palma, Majorca

This MD-83 made its first flight from Long Beach on 25 January 1988. Bought by SAS Leisure in 1991 it was on lease to Spanair when, on 6 September 1994, the airliner was damaged by an electrical fire at Palma, Majorca. The MD-83 was ferried back to Oslo for repairs and is still in service today. By the end of December 1996 it had flown a total of 23,483 hours and accomplished 10,866 landings.

3 November 1994: MD-83 F-GHED Kajaani, Finland

Bought by Air Liberte and registered F-GHED on 4 May 1990 F-GHED was leased to Air Liberte Tunisia. Damage was sustained when it touched down too far beyond the runway threshold at Kajaani airport, Finland, and veered off the runway. It was thought the airliner would be written-off, but it is still listed as current and up to the end of December 1996 it had flown a total of 20,851 hours and accomplished 10,253 landings. It is powered by two JT8D-219 turbofan engines.

22 November 1994: MD-82 N954U St Louis, MI, USA

Completed at Long Beach on 17 July 1987, it was delivered on 4 December 1987 to Polaris Aircraft Leasing Corporation and leased to TWA on 31 December 1987 with fleet no 9054. On 22 November 1994 N954U hit a wing of Cessna 441 N441KM whilst taxiing for take off at St Louis International Airport, Missouri. The cabin roof and tail sheared off the Cessna killing both Cessna pilots. Damage to the MD-82 wing was repairable. The airliner is powered by two JT8D-217 turbofan engines, it is still in service with TWA and by the end of December 1996 had flown 27,867 hours and accomplished 14,410 landings.

November 1995: MD-83 N566AA Hartford, CT, USA

This MD-83 was completed at Long Beach on 27 April 1987 and delivered to American on 15 June. During November 1995 it was badly damaged when it hit trees and landed short at Hartford, Connecticut. On 25 November 1995 it was ferried to Tulsa, Oklahoma for repairs which were expected to take several months. It is powered by two JT8D-219 turbofan engines. According to Long Beach and airline records this airliner is still in service and up to the end of December 1996 had flown 30,985 hours and accomplished 14,879 landings.

5 March 1997: MD-82 N275AA Cleveland, OH, USA

Delivered to American on 13 November 1984, it was powered by two JT8D-217 turbofans and by the end of the 1996 had completed 37,345 flying hours. On 5 March 1997 it slid off the left hand side of Runway 5R on landing at Cleveland Hopkins International Airport, Ohio, after a flight from Dallas Fort Worth.

The airliner sustained an undetermined amount of damage caused by the collapse of the right main undercarriage. Three of the 103 passengers reported minor injuries, but the remainder, plus the six crew were uninjured.

8 PRODUCTION HISTORY

Airlines and operations shown in the production listing are the first operators only of each airliner produced. This does not automatically confer ownership, as since the middle 1980s large fleets of airliners have been and are still currently being purchased from the manufacturer by specialist leasing companies such as the International Lease Finance Corporation (ILFC) Beverly Hills, California, Polaris Leasing of San Francisco and the huge Guinness Peat Aviation Group based in Shannon, Eire.

The partial production listing is by f/n (fuselage number) followed by the s/n or c/n (serial or constructors number) as this system is a more accurate method of recording the production on the line in the Long Beach factory. Some airliners were ordered but never built, often leaving a blank in the f/n and s/n. Here are a few examples.

Two MD-82s s/n 48064/5 were ordered by Air California but cancelled. Likewise, s/n 48160/1/2/3/4 for Midway Airlines and three MD-82s for Pacific Southwest with s/n 49240/1/2 were also ordered and then cancelled. Muse Air ordered MD-82s and had the registrations allocated before the order was cancelled. These were N938MC s/n 49375; N939MC s/n 49376; N940MC s/n 49377, and N941MC s/n 49378. A single MD-83 s/n 49995 is unique in that it was ordered by Air 2000, the United Kingdom operator, but never built. This was followed by five for TWA, all MD-82s s/n 49496/7/8/9/500. These cancellations took place in the 1980s.

In 1993 a large batch of airplanes suffered not being built for a variety of reasons — though mostly financial. These included MD-88s f/n 2085 53424 N921DE and f/n 2087 s/n 53425 N922DE for Delta, followed by MD-82 s/n 53426. 53432/3/4 for LOT Polish Airlines, the last three being in fact MD-87s. Irish Aerospace ordered and cancelled MD-83 s/n 53427. Eight MD-83s were involved in a Shanghai Aviation Industrial Corporation order, these being s/n 53435/6/7/8/9/40/1/2.

Fuselage No	Serial No	Model	Registration	Operator	Delivery
809	49880	-81	N980DC	Douglas Aircraft Co	18/1079
817	49881	-81	N1002G	Douglas Aircraft Co	01/12/79
824	49915	-81	OE-LDP	Douglas Aircraft Co	29/02/80
				Austrian Airlines	16/05/81
838	49902	-81	HB-INC	Swissair	13/09/80
861	49916	-81	OE-LDR	Austrian Airlines	03/10/80
914	49903	-81	HB-IND	Swissair	26/10/80
926	49934	-81	N924PS	PSA	14/11/80
949	49924	-81	N10922	Austral Lineas Aereas	08/01/81
958	49904	-81	HB-INE	Swissair	21/11/80
962	49925	-81	N10927	Austral	08/01/81
983	49959	-81	JA8458	TDA	30/01/81
985	49935	-81	N925PS	PSA	31/03/81
987	49905	-81	HB-INF	Swissair	28/01/81
998	49917	-81	OE-LDS	Austrian Airlines	16/01/81
1001	49936	-81	N10928	Muse Air Corporation	29/06/81
1007	49950	-81	JA8459	TDA	05/03/81
1017	49906	-81	N926PS	PSA	09/03/81
1018	49937	-81	N927PS	PSA	08/01/81
1026	49906	-81	HB-ING	Swissair	03/04/81
1027	49944	-81	N809HA	Hawaiian Airlines	24/04/81
1031	49951	-81	JA8460	TDA	17/04/81
1035	49945	-81	N819HA	Hawaiian Airlines	04/05/81
1037	49907	-81	HB-INH	Swissair	08/05/81
1038	49927	-81	N475AC	Air California	15/05/81
1039	49952	-81	N928PS	PSA	15/05/81
1041	49961	-81	N829HA	Hawaiian Airlines	10/06/81
1042	49953	-81	YU-AJZ	Inex Adria Aviopromet	10/06/81

uselage No	Serial No	Model	Registration	Operator	Delivery
978	48013	-81	JA8461	TDA	18/06/81
979	49878	-81	N476AC	Air California	08/06/81
981	48009	-81	HB-INI	Swissair	02/07/81
984	49949	-81	N10029	Muse Air	02/07/81
985	48007	-81	HB-INK	Swissair	30/06/81
986	48014	-81	N929PS	PSA	16/07/81
988	48015	-81	JA8462	TDA	29/07/81
989	48040	-81	N10030	Austral	05/08/81
991	48058	-81	N8839HA	Hawaiian Airlines	20/07/81
992	48010	-81	HB-INL	Swissair	24/07/81
994	48011	-81	HB-INM	Swissair	05/08/81
995	48018	-81	OE-LDT	Austrian Airlines	25/07/81
996	48044	-82	N3018C	Republic Airlines	05/08/81
997	48012	-81	HB-INN	Swissair	29/08/91
998	48047	-82	YU-ANA	Inex Adria	11/08/81
999	48070	-81	JA8468	TDA	09/11/81
1000	48013	-81	HB-INO	Swissair	04/09/81
1001	48019	-81	OE-LDU	Austrian Airlines	05/09/81
1002	48020	-81	N930PS	PSA	10/09/81
1003	48030	-81	N931PS	PSA	10/09/81
1004	48071	-81	JA8469	TDA	18/12/81
1005	48048	-82	YU-ANB	Inex Adria	19/09/81
1006	48040	-81	N932PS	PSA	10/09/81
1007	48055	-82	N3028C	Republic Airlines	05/09/81
1008	48041	-81	N933PS	PSA	28/09/81
1009	48042	-81	N934PS	PSA	28/09/81
1010	48043	-81	N935PS	PSA	09/10/81
1011	48073	-81	JA8470	TDA	25/02/81
1012	48056	-82	N939MC	Muse Air	07/08/81
1013	48016	-81	HB-INP	Swissair	30/10/81
1014	48063	-82	N477AC	Air California	15/10/81
1016	48074	-82	N779JA	Jet America Airlines	14/11/81
1018	48075	-81	N849HA	Hawaiian Airlines	25/11/81
1019	48060	-82	N479AC	Air California	15/10/81
1020	48063	-82	N478AC	Air California	21/10/81
1022	48080	-82	N778JA	Jet America Airlines	14/11/81
1023	48057	-82	N941MC	Muse Air	07/05/82
1025	49100	-81	HB-INA	Swissair	12/12/81
1026	48079	-81	N859HA	Hawaiian Airlines	11/12/81
1028	48067	-82	N1003X	Aerovenco	22/12/81
1029	48066	-82	N3007C	Republic Airlines	21/12/81
1031	48068	-82	N1003Y	Aerovenco	22/12/81
1032	48069	-82	N1003Z	Aerovenco	27/12/81
1034	48097	-81	N936PS	PSA	17/12/81
1035	48087	-82	YU-ANC	Inex Adria	02/04/82
1037	48088	-82	N3098C	Republic Airlines	02/12/82
1038	48089	-82	N3118C	Republic Airlines	02/12/82
1040	48090	-82	N3128C	Republic Airlines	08/12/82
1041	48091	-82	N1004G	Republic Airlines	26/04/83
1043	48081	-82	N10033	Aerovenco	26/02/82
1041	48030	-81	OE-LDW	Austrian Airlines	12/02/82
1042	48058	-81	LE-LDW	Austrian Airlines	20/02/82
1049	48031	-81	N937PS	PSA	22/04/82

Fuselage No	Serial No	Model	Registration	Operator	Delivery
1051	49141	-81	HB-INB	Swissair	17/04/82
1054	49054	-81	N968PS	PSA	07/04/82
1055	49055	-82	N980PS	PSA	23/04/82
1057	49056	-82	N981PS	PSA	26/05/82
1059	49057	-82	N943PS	PSA	26/05/82
1060	49058	-87	N943PS	PSA	27/05/82
1061	49132	-82	N980JE	Frontier Airlines	22/06/82
1062	49120	-82	N2704L	Republic Airlines	26/08/83
1063	49137	-82	N980JE	Frontier Airlines	04/06/82
1064	49121	-82	N765JA	Jet America Airlines	09/12/83
1065	49138	-82	N980JE	Frontier Airlines	15/06/82
1066	49114	-82	N980JE	Frontier Airlines	05/12/82
1067	49059	-81	N968PS	PSA	17/04/82
1068	49122	-82	N486AC	Air California	28/06/82
1069	49115	-82	N482AC	Air California	22/06/82
1070	49116	-82	N944PS	PSA	15/07/82
1071	49120	-81	N902MC	Muse Air	28/09/82
1072	49121	-81	N903MC	Muse Air	26/09/82
1073	49122	-81	N434MC	Muse Air	14/12/82
1074	49123	-81	N905MC	Muse Air	29/11/82
1075	49124	-82	PJ-SEI	ALM-Antillean Airways	04/10/82
1076	49132	-82	N985SF	Frontier Airlines	24/11/82
1077	49124	-82	J-SEG	ALM	04/11/82
1078	49121	-81	OE-LDX	Austrian Airlines	28/02/83
1079	49122	-82	PH-MCD	Martinair Holland	28/04/83
1080	49126	-82	N766JA	Jet America Airlines	11/03/83
1082	49127	-82	N987NY	New York Air	02/09/83
1083	49128	-82	YV138C	VIASA	30/12/82
1084	49129	-82	YV139C	VIASA	30/12/82
1085	49130	-82	N505MD	Douglas Aircraft Co	
			PP-OJM	Cruzeiro do Sul	08/12/82
1087	49150	-82	OH-LMN	Finnair	11/03/83
1088	49151	-82	OH-LMO	Finnair	25/03/83
1089	49152	-82	OH-LMP	Finnair	29/04/83
1090	49146	-82	N984PS	PSA	28/04/83
1091	49147	-82	N986PS	PSA	12/05/83
1092	49149	-82	B-2301	CAAC	12/12/83
1093	49141	-82	B-2302	CAAC	12/12/83
1094	49142	-82	N987PS	PSA	17/10/83
1095	49143	-82	N988PS	PSA	17/12/82
1096	49144	-82	PH-MBZ	Martinair Holland	15/07/83
1097	49145	-82	N503AA	American Airlines	31/05/83
1098	49102	-82	N901TW	TWA Trans World Airlines	28/09/83
1099	49103	-82	N216AA	American Airlines	30/05/83
1100	49150	-82	N215AA	American Airlines	04/05/83
1101	49151	-82	N902TW	TWA	24/05/83
1102	49152	-82	N904TW	TWA	25/05/83
1103	49153	-82	N220AA	American Airlines	06/06/83
1104	49154	-82	N906TW	TWA	24/06/83
1105	49155	-82	N907TW	TWA	27/06/83
1106	49156	-82	N219AA	American Airlines	02/06/83
1107	49157	-82	N908TW	TWA	23/06/83

Fuselage No	Serial No	Model	Registration	Operator	Delivery
1109	49161	-82	N209AA	American Airlines	31/05/83
1110	49162	-82	N214AA	American Airlines	24/06/83
1111	49163	-82	N215AA	American Airlines	01/07/83
1112	49171	-82	N219AA	American Airlines	05/08/83
1113	49172	-82	N221AA	American Airlines	17/08/83
1114	49173	-82	N223AA	American Airlines	02/09/83
1115	49174	-82	N224AA	American Airlines	29/08/83
1116	49175	-82	N225AA	American Airlines	08/09/83
1117	49165	-82	N907TW	TWA	07/10/83
1118	49169	-82	N908TW	TWA	22/09/83
1119	49170	-82	N909TW	TWA	13/10/83
1120	49176	-82	N226AA	American Airlines	30/10/83
1121	49177	-82	N227AA	American Airlines	28/10/83
1122	49178	-82	N228AA	American Airlines	02/11/83
1123	49179	-82	N232AA	American Airlines	03/12/83
1124	49180	-82	N234AA	American Airlines	30/11/83
1125	49181	-82	N236AA	American Airlines	06/12/83
1126	49192	-82	I-DAWA	Alitalia	16/12/83
1127	49193	-82	I-DAWE	Alitalia	16/12/83
1128	49183	-82	N-911TW	TWA	09/12/83
1129	49184	-82	N912TW	TWA	30/12/83
1130	49194	-82	I-DAWI	Alitalia	24/02/84
1131	49184	-82	N913TW	TWA	23/03/84
1132	49185	-82	N914TW	TWA	13/04/84
1133	49186	-82	N915TW	TWA	19/04/84
1134	49187	-82	N916TW	TWA	25/04/84
1135	49115	-82	OE-LDY	Austrian Airlines	04/05/84
1136	49195	-82	I-DAWO	Alitalia	11/05/84
1137	49196	-82	I-DAWU	Alitalia	30/05/84
1138	49197	-82	I-DAWB	Alitalia	27/05/84
1139	49222	-82	N802NY	New York Air	25/06/84
1140	49229	-82	N803NY	New York Air	21/06/84
1141	49230	-82	N960JC	American Airlines	19/06/84
1142	49198	-82	I-DAWAC	Alitalia	26/06/84
1143	49199	-82	I-DAWD	Alitalia	30/06/84
1144	49217	-82	N989PS	PSA	30/06/84
1145	49245	-82	N951U	American Airlines	29/06/84
1146	49246	-82	N804NY	New York Air	06/08/84
1147	49200	-82	I-DAWT	Alitalia	24/07/84
1148	49201	-82	I-DAWG	Alitalia	30/07/84
1149	49249	-82	N805NY	New York Air	14/08/84
1150	49260	-82	N806NY	New York Air	22/08/84
1151	49247	-82	HB-IKK	Absolut	20/07/84
1152	49248	-82	HB-IKL	Absolut	27/07/84
1153	49261	-82	N807NY	New York Air	31/07/84
1154	49251	-82	N230AA	American Airlines	06/09/84
1155	49253	-82	N237AA	American Airlines	14/09/84
1156	49254	-82	N241AA	American Airlines	17/09/84
1157	49255	-82	N242AA	American Airlines	17/09/84
1158	49256	-82	N244AA	American Airlines	27/09/84
1159	49262	-82	N808NY	New York Air	18/11/84
1160	49257	-82	N245AA	American Airlines	27/11/84
1161	49258	-82	N246AA	American Airlines	30/10/84

Fuselage No	Serial No	Model	Registration	Operator	Delivery
1165	[illegible]	82	N548AA	American Airlines	15/10/86
1166	[illegible]	82	N950NY	New York Air	14/11/86
1167	[illegible]	82	N549AA	American Airlines	26/10/86
1168	[illegible]	82	N551AA	American Airlines	6/11/86
1169	[illegible]	82	N552AA	American Airlines	05/11/86
1170	[illegible]	82	N553AA	American Airlines	14/11/86
1171	[illegible]	82	N554AA	American Airlines	26/11/86
1172	[illegible]	82	OH-LMS	Finnair	19/12/86
1173	[illegible]	82	I-DAWH	Alitalia	09/11/86
1174	[illegible]	82	N952NY	New York Air	20/12/86
1175	[illegible]	83	XA-AMO	Aeromexico	17/12/86
1176	[illegible]	82	XA-AMP	Aeromexico	29/12/86
1177	[illegible]	83	I-DAWJ	ATI	18/12/86
1178	[illegible]	82	N554AA	American Airlines	04/01/87
1179	[illegible]	82	N555AA	American Airlines	15/01/87
1180	[illegible]	82	N980AS	Alaska Airlines	29/01/87
1181	[illegible]	82	N981AS	Alaska Airlines	30/01/87
1182	[illegible]	83	I-DAWL	Alitalia	19/02/87
1183	[illegible]	82	XA-AMQ	Aeromexico	18/02/87
1184	[illegible]	87	HB-INR	Dalair	01/02/87
1185	[illegible]	81	OE-LDZ	Austrian Airlines	18/02/87
1186	[illegible]	83	LV-LMA	Austral Argentina	27/02/87
1187	[illegible]	83	I-DAWM	Alitalia	27/02/87
1188	[illegible]	82	N951NY	New York Air	29/03/87
1189	[illegible]	83	N952NY	New York Air	04/04/87
1190	[illegible]	83	N958AA	American Airlines	08/04/87
1191	[illegible]	82	I-DAWP	Alitalia	15/04/87
1192	[illegible]	82	I-DAWO	Alitalia	20/04/87
1193	[illegible]	82	I-DAWR	Alitalia	25/04/87
1194	[illegible]	82	I-DAWS	Alitalia	02/04/87
1195	[illegible]	83	I-DAWT	ATI	08/04/87
1196	[illegible]	83	N959AA	American Airlines	08/04/87
1197	[illegible]	81	JA8496	TDA	09/04/87
1198	[illegible]	83	N962AA	American Airlines	19/04/87
1199	[illegible]	82	N917TW	TWA	24/04/87
1200	[illegible]	82	N918TW	TWA	25/04/87
1201	[illegible]	82	N919TW	TWA	02/05/87
1202	[illegible]	82	N920TW	TWA	08/05/87
1203	[illegible]	81	JA8497	TDA	20/05/87
1204	[illegible]	87	HB-IHZ	Swissair	10/08/87
1205	[illegible]	83	I-DAWV	ATI	24/05/87
1206	[illegible]	82	N962AS	Alaska Airlines	14/06/87
1207	[illegible]	82	N963AS	Alaska Airlines	28/06/87
1208	[illegible]	82	YU-ANG	Inex Adria	08/06/87
1209	[illegible]	83	N816NY	New York Air	25/06/87
1210	[illegible]	83	N817NY	New York Air	28/06/87
1211	[illegible]	82	HB-IHX	Swissair	21/08/87
1212	[illegible]	83	OH-LMR	Finnair	26/06/87
1213	[illegible]	83	N296AA	American Airlines	02/07/87
1214	[illegible]	83	N297AA	American Airlines	10/07/87
1215	[illegible]	83	N271AA	American Airlines	16/07/87
1216	[illegible]	83	N278AA	American Airlines	17/07/87
1217	[illegible]	83	N279AA	American Airlines	28/07/87

Fuselage No	Serial No	Model	Registration	Operator	Delivery
1218	[illegible]	83	N280AA	American Airlines	[illegible]
1219	[illegible]	82	N281AA	American Airlines	[illegible]
1220	[illegible]	83	N282AA	American Airlines	[illegible]
1221	[illegible]	82	N283AA	American Airlines	[illegible]
1222	[illegible]	83	N284AA	American Airlines	[illegible]
1223	[illegible]	82	N285AA	American Airlines	[illegible]
1224	[illegible]	82	N286AA	American Airlines	[illegible]
1225	[illegible]	83	OY-KGT	SAS - Scandinavian Airlines System	[illegible]
1226	[illegible]	82	N287AA	American Airlines	[illegible]
1227	[illegible]	83	N288AA	American Airlines	[illegible]
1228	[illegible]	82	N289AA	American Airlines	02/10/88
1229	[illegible]	82	N290AA	American Airlines	07/10/88
1230	[illegible]	83	OE-LMB	Austrian Airlines	30/10/88
1231	[illegible]	83	OY-KGZ	SAS	26/10/88
1232	[illegible]	83	LN-RLE	SAS	06/10/88
1233	[illegible]	83	I-DAWW	ATI	04/11/88
1234	[illegible]	83	N963AS	Alaska Airlines	29/11/88
1235	[illegible]	83	N965AS	Alaska Airlines	30/12/88
1236	[illegible]	82	LN-RLF	SAS	12/11/88
1237	[illegible]	82	SE-DDS	SAS	04/12/88
1238	[illegible]	82	N953U	Ozark Air Lines	27/11/88
1239	[illegible]	82	N958U	Ozark Air Lines	01/12/88
1240	[illegible]	83	B2106	CAAC	16/11/88
1241	[illegible]	82	B2108	CAAC	2/12/88
1242	[illegible]	82	N951PS	PSA	7/04/89
1243	[illegible]	82	I-DAWY	ATI	28/12/88
1244	[illegible]	83	SE-DFT	SAS	20/12/88
1245	[illegible]	87	I-DAWZ	ATI	28/12/88
1246	[illegible]	83	N297AA	American Airlines	30/01/89
1247	[illegible]	82	N278AA	American Airlines	14/01/89
1248	[illegible]	83	N400AA	American Airlines	17/01/89
1249	[illegible]	82	N70401	American Airlines	24/01/89
1250	[illegible]	81	HB-INS	Swissair	25/01/89
1251	[illegible]	81	HB-INT	Swissair	14/02/89
1252	[illegible]	81	OE-LMC	Austrian Airlines	28/02/89
1253	[illegible]	83	I-DAWA	ATI	24/03/89
1254	[illegible]	83	OY-KGY	SAS	16/03/89
1255	[illegible]	87	N402AA	American Airlines	28/02/89
1256	[illegible]	83	N401AA	American Airlines	24/03/89
1257	[illegible]	83	N70405	American Airlines	04/04/89
1258	[illegible]	82	N403AA	American Airlines	07/04/89
1259	[illegible]	82	N406AA	American Airlines	11/04/89
1260	[illegible]	83	N2106	SAIC / CAAC	31/03/89
1261	[illegible]	84	D-ALLD	Aero Lloyd	14/04/89
1262	[illegible]	83	I-DAWB	Alitalia	27/04/89
1263	[illegible]	87	SE-DFU	SAS	21/04/89
1264	[illegible]	87	SE-DFV	SAS	26/04/89
1265	[illegible]	83	N407AA	American Airlines	01/05/89
1266	[illegible]	83	N408AA	American Airlines	04/05/89

Fuselage No	Serial No	Model	Registration	Operator	Delivery
1267	49378	-83	N409AA	American Airlines	11/04/86
1268	49217	-82	I-DAVC	ATI	24/04/86
1269	49360	-83	9Y-THN	BWIA International	25/04/86
1270	49361	-82	EI-BTA	Frontier Airlines	29/04/86
1271	49416	-83	HL7225	Korean Air Lines	14/05/86
1272	49362	-83	EI-BTB	Frontier Airlines	01/05/86
1274	49431	-83	N410AA	American Airlines	19/05/86
1275	49218	-87	I-DAWD	ATI	21/05/86
1276	49363	-83	N906AS	Alaska Airlines	29/05/86
1276	49364	-83	N907AS	Alaska Airlines	28/05/86
1277	49365	-83	N908AS	Alaska Airlines	03/06/86
1278	49417	-82	HL7226	Korean Air Lines	01/06/86
1279	49363	-82	EI-BTC	Frontier Airlines	02/06/86
1280	49432	-83	N401AA	American Airlines	06/06/86
1281	49424	-87	N412AA	American Airlines	24/06/86
1282	49582	-81	JA8496	TDA	20/06/86
1283	49423	-87	LN RLG	SAS	27/06/86
1284	49426	-82	SE DFX	SAS	20/06/86
1285	49366	-83	EI-BTD	Frontier Airlines	25/06/86
1286	49495	-83	YV-36C	LAV	30/06/86
1287	49486	-83	N284JA	Jet America Airlines	02/12/86
1288	49487	-87	N285JA	Jet America Airlines	02/12/86
1289	49374	-82	N411AA	American Airlines	14/07/86
1290	49425	-82	N413AA	American Airlines	18/07/86
1291	49643	-82	N952PS	PSA	28/07/86
1292	49569	-83	B2107	SAIC 2/CAAC	12/12/86
1293	49678	-83	N418NY	New York Air	08/08/86
1294	49568	-81	HB-INU	Swissair	28/07/86
1295	49376	-87	N415AA	American Airlines	05/08/86
1296	49527	-82	N416AA	American Airlines	08/08/86
1297	49679	-87	N419NY	New York Air	14/08/86
1298	49680	-82	N820NY	New York Air	29/08/86
1299	49584	-81	JA8499	TDA	12/09/86
1300	49502	-83	B2108	SAIC 1/CAAC	12/04/88
1301	49378	-87	N417AA	American Airlines	22/08/86
1302	49379	-87	N418AA	American Airlines	28/08/86
1303	49639	-81	OY-KHC	SAS	08/09/86
1304	49669	-83	YU-ANO	Adria Airways	10/09/86
1305	49506	-83	SE-DHB	Transwede Airways	24/09/86
1306	49635	-83	N419AA	American Airways	12/09/86
1307	49432	-87	N420AA	American Airlines	10/09/86
1308	49485	-83	N72801	Continental Airlines	30/09/86
1309	49683	-87	N72822	Continental Airlines	04/10/86
1310	49219	-82	I-DAWF	ATI	09/10/86
1311	49633	-83	N77421	American Airlines	07/10/86
1312	49634	-82	N422AA	American Airlines	10/10/86
1313	49648	-83	9Y-THQ	BWIA International	17/10/86
1314	49684	-87	N76824	Continental Airlines	22/10/86
1315	49664	-83	N72824	Continental Airlines	04/11/86
1316	49665	-87	N72825	Continental Airlines	14/11/86
1317	49696	-82	N69826	Continental Airlines	25/11/86
1318	49697	-83	N18003	Continental Airlines	19/12/86
1319	49654	-83	I-DAWG	ATI	19/11/86

Fuselage No	Serial No	Model	Registration	Operator	Delivery
1320	49345	-83	N401AA	American Airlines	16/04/87
1321	49346	-83	N424AA	American Airlines	27/04/87
1322	49401	-87	N1888B	Continental Airlines	30/04/87
1323	49444	-83	N996MC	Transtar Airlines	12/05/87
1324	49445	-87	N997MC	Transtar Airlines	12/05/87
1325	49531	-87	N70425	American Airlines	15/11/86
1326	49366	-8	N987MD	Douglas Aircraft Co	04/12/86
1327	49438	-87	N426AA	American Airlines	26/11/86
1328	49439	-82	N427AA	American Airlines	05/12/86
1329	49440	-87	N428AA	American Airlines	08/12/86
1330	49221	-83	I-DAVH	ATI	09/12/86
1331	49497	-83	SE-DHC	Transwede Airlines	16/07/87
1332	49498	-83	G-PATA	Paramount Airways	24/07/87
1334	49589	-87	SE-DHG	Douglas Aircraft Co	14/01/87
1336	49430	-87	I-DAVI	Transwede Airways	04/08/88
1335	49487	-82	N77827	Alitalia	09/12/86
1336	49501	-82	N429AA	Continental Airlines	30/12/86
1337	49502	-82	N430AA	American Airlines	23/12/86
1338	49632	-82	N901DL	American Airlines	06/01/87
1339	49543	-82	N431AA	Delta Air Lines	09/01/87
1340	49528	-83	N938MC	American Airlines	26/05/87
1341	49503	-82	N902DL	Transtar Airlines	23/01/87
1342	49536	-83	N939MC	Delta Air Lines	12/01/87
1343	49599	-83	F-GGMA	Transtar Airlines	12/01/87
1344	49534	-87	N903DL	Minerve	18/03/87
1345	49417	-82	LN RLK	Delta Air Lines	18/04/87
1346	49503	-87	B2109	SAS	06/04/87
1347	49535	-87	N904DL	SAIC 4/China Eastern	16/07/88
1348	49536	-87	N905DL	Delta Air Lines	28/04/87
1349	49559	-81	HB-INV	Delta Air Lines	01/05/87
1350	49468	-82	N71828	Swissair	18/03/87
1351	49489	-83	N72829	Continental Airlines	02/04/87
1352	49490	-82	N72830	Continental Airlines	10/04/87
1353	49438	-81	SE-DFY	Continental Airlines	10/04/87
1354	49439	-83	D-ALLI	SAS	10/04/87
1355	49553	-87	N906DL	Aero Lloyd	30/04/87
1356	49801	-83	G-PATB	Delta Air Lines	24/04/87
1357	49805	-83	EC-ECN	Paramount Airways	24/07/87
1358	49817	-83	EC-ECO	Canadiria Transportes Aereos	29/04/87
1359	49861	-87	JA8260	Canadiria	28/04/87
1360	49891	-83	N14831	TDA	16/05/87
1361	49892	-82	N8838Z	Continental Airlines	05/05/87
1362	49531	-83	I-SMEG	Continental Airlines	15/05/87
1363	49504	-87	B2120	Alitalia	21/05/87
1364	49893	-83	N18833	SAIC 5/China Eastern	01/11/88
1365	49538	-87	N907DL	Continental Airlines	19/05/87
1366	49539	-87	N908DL	Delta Air Lines	21/05/87
1367	49567	-83	YV-38C	Delta Air Lines	14/05/87
1368	49591	-87	N10843	LAV	20/05/87
1369	49592	-87	N14846	Continental Airlines	29/05/87
1370	49844	-83	N963AA	Continental Airlines	15/09/87
1371	49845	-83	N961AA	American Airlines	11/06/87
				American Airlines	05/06/87

Fuselage No	Serial No	Model	Registration	Operator	Delivery
1371	49356	-83	N964AA	American Airlines	08/06/87
1374	49357	-83	N965AA	American Airlines	11/06/87
1375	49358	-83	N966AA	American Airlines	13/06/87
1377	49359	-83	N968AA	American Airlines	18/06/87
1379	49360	-82	N440AA	American Airlines	19/06/87
1377	49361	-83	I-DAWJ	Alitalia	30/06/87
1376	49362	-82*	I-DAWK	Alitalia	03/06/87
1409	49363	-81	EM ERMA	SAS	07/07/87
1399	49364	-83	9V-THR	BSWIA International	29/06/87
1401	49365	-87	B2121	SAIC o/China Northern	15/12/88
1392	49827	-83	N931TW	TWA	10/07/87
1393	49828	-83	N900JD	TWA	16/07/87
1394	49829	-83	N15841	Continental Airlines	21/07/87
1405	49830	-83	N440AA	American Airlines	13/07/87
1396	49831	-83	N470AA	American Airlines	16/07/87
1397	49832	-83	N471AA	American Airlines	20/07/87
1406	49833	-87	N433AA	American Airlines	22/07/87
1389	49834	-87	N434AA	American Airlines	24/07/87
1390	49835	-82	N435AA	American Airlines	29/07/87
1371	49836	-83	N436AA	American Airlines	31/07/87
1391	49837	-82*	N437AA	American Airlines	05/08/87
1383	49838	-83*	N438AA	American Airlines	07/08/87
1384	49839	-87	HL7282	Korean Air Lines	18/08/87
1393	49840	-88	N904DL	Douglas Aircraft Co	20/08/87
				Delta Air Lines	29/12/87
1398	49829	-83	N440K	TWA	04/09/87
1377	49830	-83	N940DC	TWA	09/09/87
1378	49837	-82	N449AA	American Airlines	25/08/87
1400	49838	-87	N954U	TWA	04/12/87
1402	49839	-87	B2122	SAIC o/China Northern	06/06/89
1403	49837	-83	N955L	TWA	04/12/87
1380	49839	-83	OY-KHD	SAS	04/09/87
1382	49839	-82	HL7283	Korean Air Lines	09/09/87
1383	49840	-87	OH-LMA	Finnair	18/09/87
1385	49840	-87	HB-INW	Balair	18/09/87
1446	49458	-83	N572AA	American Airlines	18/09/87
1407	49459	-82	N446AA	American Airlines	21/09/87
1408	49460	-83	N441AA	American Airlines	23/09/87
1409	49468	-83	N442AA	American Airlines	28/09/87
1410	49469	-82	N446AA	American Airlines	30/09/87
1417	49470	-83	N978TC	Continental Airlines	02/10/87
1407	49471	-87	OH-LMK	Aeromo/Airlines	27/11/87
1435	49474	-83	EC-EEU	LAC	19/10/87
1430	49475	-83	EC-EEJ	Spantax Leeras/Aeroes	29/10/87
1432	49476	-82	SE-DFP	SAS	19/12/87
1433	49481	-87	N903DL	Delta Air Lines	19/12/87
1434	49479	-83	N2444	American Airlines	26/10/87
1435	49431	-83	N801AA	American Airlines	28/10/87
	49432	-87	N488GE	Continental Airlines	24/11/87
	49433	-87	N485GE	Continental Airlines	24/11/87
	49434	-83	SE-DFH	Transwede Airliner	21/02/88
	49435	-83	EC-EFK	Spantax	24/11/87
	49436	-83	G-BNSA	BIA British Island Airways	31/12/87

Fuselage No	Serial No	Model	Registration	Operator	Delivery
1413	49421	-87	OH-LMH	Austrian Airlines	30/09/87
1405	49407	-87	B2123	SMC's/China Eastern	07/12/87
1426	49423	-83	N496AA	American Airlines	30/11/87
1427	49424	-83	N447AA	American Airlines	04/12/87
1428	49433	-87	I-DAWI	Alitalia	23/01/88
1429	49462	-83	G-PATC	Paramount Airways	25/02/88
1430	49494	-82	OH-LMB	Finnair	08/01/88
1431	49474	-83	N448AA	American Airlines	27/12/87
1413	49475	-83	N449AA	American Airlines	30/12/87
1414	49476	-83	N901DL	Delta Air Lines	29/12/87
1414	49481	-88	N902DL	Delta Air Lines	29/12/87
1416	49482	-83	D-ALLE	Aero Lloyd	21/12/87
1446	49487	-87	LN-RMB	SAS	1988
1447	49463	-83	G-PATD	Paramount Airways	1988
1438	49839	-83	YV-98C	LAV	27/01/88
1439	49840	-82	N450AA	American Airlines	01/02/88
1440	49820	-81	HB-INX	Swissair	25/02/88
1441	49477	-83	N451AA	American Airlines	02/02/88
1442	49483	-81	SE-DIA	SAS	26/04/88
1443	49484	-88	N903DL	Delta Air Lines	23/02/88
1444	49491	-88	N904DL	Delta Air Lines	26/02/88
1445	49860	-83	EI-BTX	Unifly Express	20/04/88
1446	49489	-87	I-DAWM	Alitalia	01/04/88
1447	49946	-88	N905DL	Delta Air Lines	07/03/88
1448	49491	-88	N906DL	Delta Air Lines	02/03/88
1449	49949	-83	B2124	SMC's/China Northern	1988
1450	49454	-87	N452AA	American Airlines	1988
1451	49439	-82	N453AA	American Airlines	02/03/88
1452	49961	-83	SU-PAE	ZAS Airlines of Egypt	10/03/88
1453	49870	-87	D-ALLC	Aero Lloyd	15/03/88
1454	49922	-83	EC-EHT	Spantax	25/03/88
1455	49529	-82	SE-DHD	Transwede Airways	16/03/88
1456	49891	-83	OY-KHE	SAS	21/04/88
1457	49501	-82	HB-IUA	CTA	05/04/88
1458	49571	-83	EI-BNY	Swissair	26/03/88
1459	49852	-83	N909AS	Alaska Airlines	08/04/88
1460	49599	-87	N454AA	American Airlines	31/03/88
1461	49856	-83	G-BNSB	BIA	1988
1462	49860	-83	N455AA	American Airlines	1988
1463	49871	-87	D-ALLH	Aero Lloyd	15/04/88
1464	49853	-83	F-GGMB	Minerve	29/04/88
1465	49579	-83	EC-EIG	Spantax	29/04/88
1466	49862	-83	EI-BTY	Unifly Express	15/05/88
1467	49858	-83	EC-EIK	Open International Airlines	26/05/88
1468	49922	-83	HB-INZ	Swissair	1988
1469	49973	-88	N907DL	Delta Air Lines	1988
1470	49963	-88	N908DL	Delta Air Lines	16/05/88
1471	49959	-88	N909DL	Delta Air Lines	19/05/88
1472	49886	-87	HB-IUB	CTA	16/05/88
1473	49644	-88	N910DL	Delta Air Lines	06/06/88
1474	49961	-82	N456AA	American Airlines	1988
1475	49962	-83	N457AA	American Airlines	1988
1476	49464	-87	JA8279	Japan Air System	02/06/88

Fuselage No	Serial No	Model	Registration	Operator	Delivery
1477	49662	-81	JA8261	Japan Air System	24/06/88
1478	49705	-82	N14846	TWA	17/06/88
1479	49702	-82	N14847	TWA	17/06/88
1480	49645	-88	N921DL	Delta Air Lines	08/06/88
1481	49646	-88	N922DL	Delta Air Lines	15/06/88
1482	49589	-82	B2125	SAIC 10/China Eastern	08/11/89
1483	49619	-83	EI BTU	Unifly Express	30/06/88
1484	49620	-83	EI BTV	Unifly Express	01/07/88
1485	49663	-82	N458AA	American Airlines	17/06/88
1486	49564	-82	N459AA	American Airlines	21/06/88
1487	49707	-83	F-GLZB	Air Liberte/AOM	26/07/88
1488	49665	-81	JA8262	Japan Air System	21/07/88
1489	49703	-82	N958U	TWA	06/07/88
1490	49704	-82	N959C	TWA	06/07/88
1491	49705	-88	N923DL	Delta Air Lines	15/07/88
1492	49711	-88	N924DL	Delta Air Lines	27/07/88
1493	49669	-82	I-SMEV	Alisarda	19/07/88
1494	49672	-83	EC-EJQ	Spanair	27/07/88
1495	49621	-83	EC-EJU	Spanair	29/07/88
1496	49565	-82	N460AA	American Airlines	26/07/88
1497	49566	-82	N461AA	American Airlines	02/08/88
1498	49622	-83	EC-EJZ	LMC Lineas Aereas Canarias	16/08/88
1499	49623	-83	SE-DHN	Transwede Airlines	19/08/88
1501	49712	-88	N925DL	Delta Air Lines	16/08/88
1501	49695	-87	SE-DIB	SAS	26/10/88
1502	49624	-83	EC-EKM	Oasis International	24/08/88
1503	49625	-83	OH-LMG	Finnair	26/08/88
1504	49645	-82	I-DAWN	ATI	06/10/88
1505	49572	-82	N462AA	American Airlines	30/08/88
1506	49573	-82	N463AA	American Airlines	31/08/88
1507	49574	-82	N464AA	American Airlines	12/09/88
1508	49673	-87		Douglas Aircraft Co	07/09/88
1509	49575	-82	N465AA	American Airlines	14/09/88
1510	49576	-82	N466AA	American Airlines	19/09/88
1511	49577	-82	N467AA	American Airlines	22/09/88
1512	49627	-87	SE-DIC	SAS	30/09/88
1513	49578	-82	N468AA	American Airlines	28/09/88
1514	49610	-82	B2126	SAIC 11/China Northern	12/89
1515	49579	-82	N469AA	American Airlines	27/09/88
1516	49580	-82	N470AA	American Airlines	04/10/88
1517	49628	-87	OY-KHI	SAS	07/10/88
1518	49693	-82	N471AA	American Airlines	07/10/88
1519	49611	-81	OY-KHG	SAS	14/10/88
1520	49647	-82	N472AA	American Airlines	12/10/88
1521	49648	-82	N473AA	American Airlines	17/10/88
1522	49611	-87	EI-CMG	SAS	08/11/88
1523	49712	-88	N926DL	Delta Air Lines	28/10/88
1524	49714	-88	N927DL	Delta Air Lines	01/11/88
1525	49695	-87	OH-LMC	Finnair	24/10/88
1526	49649	-82	N474AA	American Airlines	25/10/88
1527	49650	-82	N475AA	American Airlines	02/11/88
1528	49651	-82	N476AA	American Airlines	28/10/88
1529	49652	-82	N477AA	American Airlines	07/11/88

Fuselage No	Serial No	Model	Registration	Operator	Delivery
1530	49715	-88	N928DL	Delta Air Lines	17/11/88
1531	49716	-88	N929DL	Delta Air Lines	17/11/88
1532	49717	-88	N930DL	Delta Air Lines	18/11/88
1533	49718	-88	N931DL	Delta Air Lines	08/12/88
1534	49653	-82	N478AA	American Airlines	22/11/88
1535	49654	-82	N479AA	American Airlines	28/11/88
1536	49655	-82	N480AA	American Airlines	30/11/88
1537	49511	-82	B2127	SAIC 12/China Eastern	12/89
1538	49626	-83	EC-EMG	LAC	06/12/88
1539	49822	-83	F-GHEB	Air Liberte	20/12/88
1540	49823	-83	G-BISC	BIA	23/12/88
1541	49587	-87	HB-IUC	CTA	16/12/88
1542	49709	-83	F-GGMC	Minerve	05/12/88
1543	49615	-82	OE-DID	SAS	08/12/88
1544	49549	-82	I-DAVP	ATI	16/12/88
1545	49656	-82	N481AA	American Airlines	12/12/88
1546	49675	-82	N482AA	American Airlines	16/12/88
1547	49710	-83	XA-TOR	Lineas Aereas La Tur	15/12/88
1548	49512	-82	B2128	SAIC 13/China Northern	12/89
1549	49724	-87	N801ML	Midway Airlines	29/03/89
1550	49676	-82	N483AA	American Airlines	20/12/88
1551	49677	-82	N484AA	American Airlines	21/12/88
1552	49725	-87	N802ML	Midway Airlines	30/04/89
1553	49728	-82	SE-DIL	SAS	24/02/89
1554	49824	-83	9Y-THU	BWIA International	24/12/88
1555	49678	-82	N485AA	American Airlines	11/01/89
1556	49614	-87	OY-KHI	SAS	04/04/89
1557	49679	-82	N486AA	American Airlines	20/01/89
1558	49680	-82	N487AA	American Airlines	25/01/89
1559	49760	-83	D-ALLK	Aero Lloyd	01/02/89
1560	49681	-82	N488AA	American Airlines	06/01/89
1561	49708	-83	XA-TUR	Lineas Aereas La Tur	28/02/89
1562	49682	-82	N489AA	American Airlines	08/02/89
1563	49683	-82	N490AA	American Airlines	06/02/89
1564	49684	-82	N491AA	American Airlines	22/02/89
1565	49730	-82	N492AA	American Airlines	15/02/89
1566	49731	-82	N493AA	American Airlines	14/02/89
1567	49732	-82	N494AA	American Airlines	21/02/89
1568	49513	-82	B2129	SAIC 14/China Eastern	12/89
1569	49606	-87	SE-DIT	SAS	02/03/89
1570	49719	-88	N932DL	Delta Air Lines	24/03/89
1571	49720	-88	N933DL	Delta Air Lines	11/04/89
1572	49608	-87	SE-DIH	SAS	31/03/89
1573	49565	-83	D-AGWA	German Wings	27/01/89
1574	49721	-88	N934DL	Delta Air Lines	18/04/89
1575	49722	-88	N935DL	Delta Air Lines	25/04/89
1576	49723	-88	N936DL	Delta Air Lines	28/04/89
1577	49825	-83	N940AS	Alaska Airlines	31/03/89
1579	49844	-81	HB-ISX	Swissair	31/04/89
1580	49627	-83	EC-EQZ	Spanair	26/04/89
1581	49566	-83	D-AGWB	German Wings	30/03/89
1582	49628	-83	EC-EQM	Oasis International	26/04/89
1584	49629	-83	EC-EQV	Oasis International	15/05/89

Fuselage No	Serial No	Model	Registration	Operator	Delivery
1564	49530	-82	I-DAWR	ATI	24-04-89
1584	49547	-83	D-ACWC	German Wings	10-05-89
1585	49551	-82	I-DAWS	ATI	01-06-89
1587	49567	-87	D-ALLI	Aero Lloyd	05-05-89
1588	49610	-88	N967DL	Delta Air Lines	20-05-89
1589	49614	-83	RP-C	SAIC 17 China Northern	1?-89
1590	49611	-88	N968DL	Delta Air Lines	26-05-89
1591	49648	-87	EC-???-	Spanair	05-06-89
1592	49649	-83	D-ACWD	German Wings	22-05-89
1593	49613	-88	N969DL	Delta Air Lines	26-05-89
1594	49672	-83	OH-LMT	Finnair	30-05-89
1595	49698	-87	D-ALLJ	Aero Lloyd	31-05-89
1596	49649	-83	EC-FPM	Open International	19??6-89
1597	49653	-83	I-DAWT	ATI	06-06-89
1598	49697	-81	JAS-94	Japan Air System	16-06-89
1599	49615	-88	N970DL	Delta Air Lines	17-06-89
1600	49794	-87	I-DAWU	ATI	30-06-89
1601	49838	-83	D-ALLL	Aero Lloyd	30-06-89
1602	49814	-88	N971DL	Delta Air Lines	22-06-89
1603	49635	-83	9V-THV	BWIA International	12-07-89
1604	49865	-81	JAS-079	Japan Air System	28-07-89
1605	49815	-88	N972DL	Delta Air Lines	29-07-89
1606	49734	-88	N794PL	Midway Airlines	21-12-89
1607	49644	-87	N654AA	American Airlines	22-07-89
1608	49816	-88	N973DL	Delta Air Lines	02-08-89
1609	49813	-82	B-2142	SAIC 16 China Eastern	12-12-89
1610	49639	-83	N807ML	Midway Airlines	24-07-89
1611	49819	-83	F-GCMD	Minerve	27-07-89
1612	49817	-88	N974DL	Delta Air Lines	12-08-89
1613	49818	-88	N975DL	Delta Air Lines	23-08-89
1614	49700	-87	SE-DIH	Transwede Airlines	05-09-89
1615	49821	-83	JAS-?95	Japan Air System	12-09-89
1616	49651	-83	N941As	Alaska Airlines	16-08-89
1617	49841	-83	HB-IUD	CTA	18-08-89
1618	49649	-87	I-SMEP	Alisarda	23-08-89
1619	49743	-83	N496AA	American Airlines	18-08-89
1620	49649	-88	N185PI	Midwest Express	01-12-89
1621	49651	-87	M-804ML	Midway Airlines	11-09-89
1622	49819	-83	B-2142	SAIC 17 China Northern	27-09-89
1623	49649	-88	N184L	Astoreo.co	30-11-89
1624	49763	-88	N665ME	Midwest Express	17-11-89
1625	49805	-83	SE-DIH	SAS	02-10-89
1626	49765	-88	N190PI	Astoreo.co	30-11-89
1627	49749	-83	N995MD	Austral Lineas Aereas	05-09-89
1628	49765	-83	HL7251	Korean Air Lines	14-09-89
1629	49819	-88	N976DL	Delta Air Lines	20-09-?9
1630	49833	-83	OH-LMU	Finnair	??09-89
1631	49799	-83	9V-THW	BWIA International	31/09/89
1632	49749	-88	N183PI	Astoreo.co	30/11/89
1633	49833	-83	B2142	SAIC 16	
1634	49649	-83	N995ML	Midway Airlines	??-09-89
1635	49833	-87	N661AA	American Airlines	?0/09/89
1636	49833	-83	HL7254	Korean Air Lines	?0/09/89

Fuselage No	Serial No	Model	Registration	Operator	Delivery
1637	49661	-83	G-PSTD	Paramount Airways	25-09-89
1638	49910	-83	OY-KHK	SAS	29-09-89
1639	49911	-82	I-DAVV	Alitalia	12-09-89
1640	49726	-87	N990AA	American Airlines	09-10-89
1641	49749	-87	N991AA	American Airlines	12-10-89
1642	49749	-83	9V-THN	BWIA International	30-10-89
1643	49749	-82	EC-407	Spanair	24-10-89
1644	49791	-83	I-DAVN	Alitalia	30-10-89
1645	49745	-87	N992AA	American Airlines	01-11-89
1646	49779	-87	N993AA	American Airlines	06-11-89
1647	49949	-87	B-2134	SAIC 19 China Northern	19??6-89
1648	49734	-87	N994AA	American Airlines	30-11-89
1649	49833	-87	N435U	American Airlines	01-12-89
1650	49749	-82	N-?????	American Airlines	01-12-89
1651	49749	-82	N995AA	American Airlines	06-11-89
1652	49901	-83	OY-KHL	SAS	07-11-89
1653	49825	-82	EC-???-	Iberia	30-09-89
1654	49829	-87	N-RPH	Astoreo.co	22-11-89
1655	49734	-83	C-GKMA	Minerve Canada	01-12-89
1656	49749	-87	N992PL	Midway Airlines	21-12-89
1657	49749	-82	B-	SAIC 20 China Eastern	05-09-89
1658	49901	-83	LN-RMH	SAS	01-12-89
1659	49949	-87	N?99-	American Airlines	08-12-89
1660	49901	-83	N997TA	American Airlines	08-12-89
1661	49901	-87	N?69N	American Airlines	20-12-89
1662	49901	-87	N?69-	American Airlines	11-12-89
1663	49749	-88	N967DL	Delta Air Lines	21-12-89
1664	49901	-83	SE-DIE	SAS	15-12-89
1665	49749	-88	N968DL	Delta Air Lines	29-12-89
1666	49749	-83	EC-FLD	Iberia	06-??-89
1667	49949	-83	F-GHEI	Air Liberte	??-12-89
1668	49901	-83	N410AM	American Airlines	15-12-89
1669	49749	-88	N997ML	Midway Airlines	27-12-89
1670	49749	-87	B2136	SAIC 23	??-??-89
1671	49901	-87	N985AA	American Airlines	27-12-89
1672	49901	-83	N?512A	American Airlines	27-12-89
1673	49749	-88	N969ML	Midway Airlines	??-??-??
1674	49749	-83	D-ALLM	Aero Lloyd	??-??-??
1675	49749	-88	N969DL	Delta Air Lines	??-??-??
1677	49901	-88	N998DL	Delta Air Lines	21-??-??
1678	49901	-83	EC-FUC	Iberia	??-??-
1679	49901	-88	N983DL	Delta Air Lines	??-??-??
1680	49901	-83	OH-LMW	Finnair	??-??-??
1681	49901	-83	OE-LMM	Austrian Airlines	??-
1682	49749	-87	OE-LMN	Austrian Airlines	??-
1683	49901	-88	N983DL	Delta Air Lines	??-??-??
1684	49749	-82	EC-FLL	Iberia	??-??-??
1685	49901	-88	N985DL	Delta Air Lines	21-??-??
1686	49901	-87	N513AA	American Airlines	08-??-??
1687	49749	-87	D-ALLN	Aero Lloyd	??-??-??
1688	49901	-87	EC-FVB	Iberia	??-??-??
1689	49901	-88	N986DL	Delta Air Lines	??-??-??
1690	49821	-87	B2137	SAIC 22	??-??-??

Fuselage No	Serial No	Model	Registration	Operator	Delivery
[illegible]	[illegible]	-88	N9[illegible]DL	Delta Air Lines	11/93/90
[illegible]	[illegible]	-83	OE-LMO	Austrian Airlines	[illegible]
[illegible]	[illegible]	-81	OY-KHM	SAS	[illegible]
[illegible]	[illegible]	-82	N7514A	American Airlines	[illegible]
[illegible]	[illegible]	-83	N[illegible]	American Airlines	[illegible]
[illegible]	[illegible]	-83	N[illegible]AA	American Airlines	[illegible]
[illegible]	[illegible]	-82	N7533A	American Airlines	[illegible]
[illegible]	[illegible]	-87	N[illegible]A	American Airlines	[illegible]
[illegible]	[illegible]	-88	N9[illegible]DL	Delta Air Lines	[illegible]
[illegible]	[illegible]	-88	N9[illegible]DL	Delta Air Lines	[illegible]
[illegible]	[illegible]	-88	N9[illegible]DL	Delta Air Lines	[illegible]
[illegible]	[illegible]	-83	B2149	SAIC 243	[illegible]
[illegible]	[illegible]	-87	EC-EAI	Iberia	[illegible]
[illegible]	[illegible]	-83	EC-EYZ	Aviaco	[illegible]
[illegible]	[illegible]	-87	LN-RMK	SAS	
[illegible]	[illegible]	-87	EC-EQG	Iberia	29/03/90
[illegible]	[illegible]	-87	N[illegible]A	American Airlines	[illegible]
[illegible]	[illegible]	-83	N[illegible]A	American Airlines	[illegible]
[illegible]	[illegible]	-83	N7521A	American Airlines	[illegible]
[illegible]	[illegible]	-88	N9[illegible]R	Delta Air Lines	[illegible]
[illegible]	[illegible]	-88	N9[illegible]DL	Delta Air Lines	[illegible]
[illegible]	[illegible]	-88	N9[illegible]DL	Delta Air Lines	[illegible]
[illegible]	[illegible]	-82	I-DAWW	ATI	[illegible]
[illegible]	[illegible]	-87	EC-EXR	Iberia	[illegible]
[illegible]	[illegible]	-88	XA-AMS	Aeromexico	[illegible]
[illegible]	[illegible]	-88	XA-AMT	Aeromexico	[illegible]
[illegible]	[illegible]	-83	EC-EXM	Iberia	[illegible]
[illegible]	[illegible]	-83	EC-EVU	Aviaco	[illegible]
[illegible]	[illegible]	-82	I-DAWX	Alitalia	[illegible]
[illegible]	[illegible]	-83	HB-ISZ	Belair	[illegible]
[illegible]	[illegible]	-87	EC-EXN	Iberia	[illegible]
[illegible]	[illegible]	-83	N7533A	American Airlines	[illegible]
[illegible]	[illegible]	-83	N[illegible]A	American Airlines	[illegible]
[illegible]	[illegible]	-83	B2149	SAIC 243	[illegible]
[illegible]	[illegible]	-88	N9[illegible]DL	Delta Air Lines	[illegible]
[illegible]	[illegible]	-88	N9[illegible]DL	Delta Air Lines	[illegible]
[illegible]	[illegible]	-87	JA8280	Japan Air System	[illegible]
[illegible]	[illegible]	-83	F-GGME	Minerve	[illegible]
[illegible]	[illegible]	-83	N7[illegible]A	American Airlines	[illegible]
[illegible]	[illegible]	-87	EC-EXT	Iberia	[illegible]
[illegible]	[illegible]	-83	N942AS	Alaska Airlines	[illegible]
[illegible]	[illegible]	-88	XA-AMU	Aeromexico	[illegible]
[illegible]	[illegible]	-87	EC-EYB	Iberia	[illegible]
[illegible]	[illegible]	-81	JA[illegible]	Japan Air System	[illegible]
[illegible]	[illegible]	-82	N7535A	American Airlines	[illegible]
[illegible]	[illegible]	-83	D-ALLO	Aero Lloyd	[illegible]
[illegible]	[illegible]	-82	I-DAWZ	ATI	[illegible]
[illegible]	[illegible]	-83	D-ALLP	Aero Lloyd	[illegible]
[illegible]	[illegible]	-82	EC-EYX	Iberia	[illegible]
[illegible]	[illegible]	-83	D-ALLQ	Aero Lloyd	[illegible]
[illegible]	[illegible]	-88	XA-AMV	Aeromexico	[illegible]
[illegible]	[illegible]	-82	N7[illegible]A	American Airlines	[illegible]

Fuselage No	Serial No	Model	Registration	Operator	Delivery
1744	49939	-82	N7532A	American Airlines	[illegible]
1745	49940	-87	EC-EYY	Iberia	[illegible]
1746	49934	-87	D-[illegible]	[illegible]	[illegible]
1747	49984	-88	N9[illegible]DL	Delta Air Lines	[illegible]
1748	49985	-88	N9[illegible]DL	Delta Air Lines	[illegible]
1749	49988	-81	JA8297	Japan Air System	[illegible]
1750	49990	-83	N7529A	American Airlines	[illegible]
1751	49941	-87	EC-EYZ	Iberia	[illegible]
1752	49991	-83	N[illegible]A	American Airlines	[illegible]
1753	49992	-82	N[illegible]	American Airlines	[illegible]
1754	49931	-83	N9[illegible]ML	Midway Airlines	[illegible]
1755	49971	-82	I-DAWM	ATI	[illegible]
1756	49932	-82	N9[illegible]ML	Midway Airlines	[illegible]
1757	49972	-82	I-DAWN	ATI	[illegible]
1758	49933	-82	N7534A	American Airlines	[illegible]
1759	49934	-82	N7536A	American Airlines	[illegible]
1760	49987	-82	N7538A	American Airlines	[illegible]
1761	49989	-82	N9[illegible]ML	Midway Airlines	[illegible]
1762	49973	-82	I-DAW[illegible]	ATI	[illegible]
1763	49942	-87	EC-EZA	Iberia	[illegible]
1764	49994	-83	N967MD	Austral	[illegible]
1765	49980	-87	N[illegible]D	Lauda	[illegible]
1766	49981	-82	N[illegible]8	Lauda	[illegible]
1767	49985	-82	OH-LMW	Finnair	[illegible]
1768	49988	-82	N7534A	American Airlines	[illegible]
1769	49989	-82	N7535A	American Airlines	[illegible]
1770	49990	-82	N7536A	American Airlines	[illegible]
1771	49943	-87	EC-EZ[illegible]	Iberia	[illegible]
1772					
1773	49995	-83	G-IECM[illegible]	Airtours International	[illegible]
1774	49974	-82	I-DAW[illegible]	ATI	[illegible]
1775	49975	-82	I-DAW[illegible]	ATI	[illegible]
1776	53044	-83	N9[illegible]ML	Midway Airlines	[illegible]
1777	53045	-83	N9[illegible]ML	Midway Airlines	[illegible]
1778	49996	-83	G-IECR[illegible]	Airtours International	[illegible]
1779	53018	-83	N9[illegible]AS	Alaska Airlines	[illegible]
1780	49941	-82	N7537A	American Airlines	[illegible]
1781	49992	-82	N7538A	American Airlines	[illegible]
1782	49993	-82	N7539A	American Airlines	[illegible]
1783	53019	-83	N941AS	Alaska Airlines	[illegible]

Swissair's OH-LMW on MD-83. Carl Ingold

Fuselage No	Serial No	Model	Registration	Operator	Delivery
1784	49937	-83	G-COES	Airtours International	21/01/90
1785	49938	-83	XA-RTK	La Tur	18/12/90
1786	49906	-82	OH-LMX	Finnair	15/11/90
1787	49939	-83	EI-CBR	Irish Aerospace	03/12/90
1788	49940	-83	G-TTPT	Airtours International	28/12/90
1789	53020	-83	N947AS	Alaska Airlines	07/12/90
1790	49994	-82	N7540A	American Airlines	04/12/90
1791	49995	-82	N7541A	American Airlines	05/12/90
1792	49996	-82	N7542A	American Airlines	10/12/90
1793	49941	-83	G-JSMC	Airtours International	14/12/90
1794	53046	-83	N907ML	Midway Airlines	03/12/90
1795	53115	-88	N966DL	Delta Air Lines	12/12/90
1796	53116	-88	N967DL	Delta Air Lines	14/12/90
1797	53017	-82	N812ML	Midway Airlines	14/12/90
1798					
1799	49942	-83	EI-CBS	Irish Aerospace	04/12/90
1800	49998	-81	SE-DIX	SAS	18/12/90
1801	53021	-83	N948AS	Alaska Airlines	21/12/90
1802	53025	-82	N7543A	American Airlines	18/12/90
1803	49999	-81	SE-DIN	SAS	21/12/90
1804	53026	-82	N7544A	American Airlines	19/12/90
1805	53027	-82	N16545	American Airlines	18/12/90
1806	53053	-82	I-DACS	Alitalia	21/12/90

MD-90-30 FUSELAGE INDEX

Fuselage No	Serial No	Registration	Operator	Delivery
2018	53367	N901DC	McDonnell Douglas	13/02/93
2094	53382	N902DA	Delta Airlines	24/02/95
2095	53383	N903DA	Delta Airlines	26/03/95
2096	53384	N904DA	Delta Airlines	24/03/95
2097	53385	N905DA	Delta Airlines	29/04/95
2098	53352	JA8062	Japan Air System	12/07/96
2099	53386	N906DA	Delta Airlines	22/07/95
2100	53381	N902DA	Delta Airlines	27/08/93
2115	53387	N907DA	Delta Airlines	17/08/95
2117	53388	N908DA	Delta Airlines	27/09/95
2120	53353	JA8063	Japan Air System	03/07/96
2122	53389	N909DA	Delta Airlines	28/10/95
2123	53390	N910DN	Delta Airlines	18/11/95
2125	53354	JA8064	Japan Air System	06/01/96
2126	53391	N911DA	Delta Airlines	17/12/95
2129	53489	N901RA	Reno Air	15/03/96
2131	53355	JA8065	Japan Air System	18/03/96
2133	53490	N902RA	Reno Air	28/03/96
2136	53392	N912DN	Delta Airlines	25/04/96
2138	53457	SE-DMF	Scandinavian Airlines	16/10/96
2140	53458	OY-KIL	Scandinavian Airlines	02/11/96
2141	53459	LN-ROA	Scandinavian Airlines	14/11/96
2142	53460	OY-KIM	Scandinavian Airlines	21/12/96
2143	53523	B2250	China Northern	28/07/96

Fuselage No	Serial No	Registration	Operator	Delivery
2144	53551	N903RA	Reno Air	30/07/96
2146	53524	B2251	China Northern	28/08/96
2147	53461	SE-DMG	Scandinavian Airlines	02/12/96
2149	53462	LN-ROB	Scandinavian Airlines	21/12/96
2150	53525	B2252	China Northern	01/09/96
2153	53534	B-16901	Eva Airways Corp	30/10/96
2154	53393	N913DN	Delta Airlines	21/10/96
2156	53394	N914DN	Delta Airlines	08/11/96
2157	53356	JA8066	Japan Air System	31/10/96
2158	53535	B-17911	Eva Airways Corp	25/11/96
2159	53395	N915DN	Delta Airlines	22/11/96
2160	53536	B-17912	Eva Airways Corp	27/11/96
2161	53396	N916DN	Delta Airlines	13/12/96
2162	53537	B-17913	Eva Airways Corp	14/12/96
2163	53552	TC-KTA	KTHY	27/03/97
2164	53357	JA8069	Japan Air System	27/12/96
2165	53553	TC-KTB	KTHY	29/03/97
2166	53554	TC-KTC	KTHY	
2168	53538	B-17915	Unit Airways Corp	28/01/97
2169	53567	B-15301	Great China Airlines	18/03/97
2170	53526	B-2253	China Northern	24/02/97
2171	53568	B-16902	EVA Airways Corp	25/04/97
2172	53539	B-17916	Uni Airways Corp	06/03/97
2173	53569			
2175	53527	B-2254	China Northern	21/03/97
2177	53528	B-2255	China Northern	10/04/97
2179	53358	JA8070	Japan Air System	03/05/97
2181	53570	N904RA	Reno Air	08/12/97
2182	53573	N905RA	Reno Air	12/12/97
2184	53574			
2190	53360	JA8020	Japan Air System	29/07/97
2191	53491	HZ-APA	Saudi Arabian	
2193	53571	B-17918	Eva Airways Corp	31/07/97
2194	53543	SE-DMH	Scandinavian Airlines	31/07/97
2195	53576	SU-BMQ	AMC Aviation, Egypt	31/07/97
2196	53359	JA8004	Japan Air System	
2197	53544	OY-KIN	Scandinavian Airlines	27/07/97
2198	53582	B-2256	China Eastern	09/10/97
2200		B-	China Eastern	09/10/97
2202	53583	B-2257	China Eastern	09/10/97
2203	53584	B-2258	China Eastern	16/12/97
2205	53492	HZ-APB	Saudi Arabian	
2207	53555	JA001D	Japan Air System	
2209	53493	HZ-APC	Saudi Arabina	
2210	53556	JA002D	Japan Air System	19/12/97
2211		JA003D	Japan Air System	26/12/97

9 CHRONOLOGY

20 Oct 1977	MDC announces start of 'Super 80' programme.
16 April 1979	MD-82 announced.
June 1979	FAA Certification awarded to the JT8D-209 engine.
18 Oct 1979	First flight of prototype MD-80.
26 Aug 1980	Type Certificate amendment covering DC-9-81 (MD-81) variant.
12 Sept 1980	First MD-80 delivered to Swissair.
5 Oct 1980	First MD-80 enters commercial service with Swissair.
8 Jan 1981	First flight of MD-82.
31 July 1981	MD-82 certificated.
Aug 1981	First MD-82 enters service with Republic Airlines.
1 Dec 1981	First fatal crash of an MD-82. YU-ANA belonging to Inex Adria crashes into Mont St Pietro, Corsica. 180 fatalities, no survivors.
26 Aug 1982	Last DC-9 series airliner completed.
28 Oct 1982	US Navy took receipt of last DC-9-32 built.
31 Jan 1983	MD-83 announced – formally called the DC- 9-80 (Super 80).
17 Dec 1984	First flight of MD-83.
12 April 1985	Agreement with General Administration of Civil Aviation of China (CAAC) for purchase of 26 MD-80s (25 to be assembled in Shanghai).
July 1985	First MD-83 enters service with Finnair.
12 Dec 1985	First delivery to CAAC of MDC-built MD-82.
4 Dec 1986	First MD-87 flight.

ABOVE: MD-82 YU-ANC is seen in Adria livery in the early 1990s. After two changes of registration, many leases and sub-leases, it became SX-BBW with Venus Airlines on 4 April 1995. *Chris Doggett*

BELOW LEFT: Paramount Airways, based at Bristol in the UK, operated a total of four MD-83s on lease from the GPA Group between April 1987 and August 1989. Unfortunately the airline encountered difficulties and a rescue package failed. This is G-PATD. *Chris Doggett*

17 June 1987	UHB prototype flight trials begin with General Electric GE36.
2 July 1987	First flight of Shanghai-assembled MD-82.
15 Aug 1987	First flight of MD-88.
21 Oct 1987	DC-9-87 (MD-87) certificated.
Nov 1987	First MD-87s enter service with Austrian Airlines and Finnair.
10 Dec 1987	MD-88 certificated.
5 Jan 1988	First MD-88 enters service with Delta.
13 April 1989	In UHB trials, first flight with Pratt & Whitney-Allison 578-DX. Howevere, UHB development had to be abandoned shortly afterwards.
14 Nov 1989	MD-90 series launched.
23 March 1992	1,000th MD-80 series airliner delivered.
11 June 1992	2,000th Douglas twin-jet airliner delivered to (American Airlines).
25 June 1992	Order approved for 20 MD-80s and 20 MD-90s (most 'Trunkliners') for China, plus options. Later renegotiated to 20 MDC-built MD-90s.
22 Feb 1993	First flight of the MD-90.
Aug 1994	MDC offers new MD-95 twin-jet airliner (first announced 1991).
16 Nov 1994	MD-90 certificated.
Nov 1994	MD-95 presented to potential customers.
1995	Long Beach celebrates the 75th anniversary of the founding of the Douglas Aircraft Company.
24 Feb 1995	First MD-90 delivered to Delta.
1 April 1995	First MD-90 in service.
Autumn 1995	Valujet orders 50 MD-95-30 airliners with option for 50 more.
27 May 1997	Final assembly starts on MD-95-30.
28 April 1997	First run of BMW Rolls-Royce BR715 engine for MD-95.
4 Aug 1997	MDC Long Beach becomes the Douglas Products Division of the Boeing Commercial Aircraft Group for $15b.
May 1988	Bavaria Int Lease Co becomes first European customer for 717-200
10 June 1998	First 717-200 (MD-95) rolled out at Long Beach.
2 Sept 1998	First flight of 717-200 from Long Beach

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$24.95US

McDonnell Douglas MD-80 & MD-90

"I built mailplanes because I couldn't sell people the dream I had from the beginning—large commercial transports. I knew the day was coming when everybody would want to travel by air, but I had to wait."

Donald W. Douglas had the dream of building large commercial aircraft and would go on to produce the DC-3, which remains in commercial service after nearly 60 years. By the time Douglas was merged with McDonnell in 1967, the company had entered the jet age with the DC-8 and DC-9, and the latter would go on to be one of the best-selling commercial jet aircraft families of the twentieth century.

McDonnell Douglas MD-80 & MD-90 is the fascinating story of this family of airliners which has served with over 40 airlines around the globe. Focused on are the MD-80 and MD-90 variants which currently number over 1,100, many that will continue serving well into the twenty-first century. Following Boeing's acquisition of the company, the MD-90 derivatives will live on in the guise of the Boeing 717-200—the erstwhile MD-95—that was rolled out in June 1998.

The original Pratt & Whitney JT8D-powered MD-80 was a stretched DC-9—the Super 80—and flew first in 1979. Four years later, it received the McDonnell Douglas designation MD-80 that would be used generally to cover a range of variants. Supported by a massive American Airlines order for 67 MD-82s (with options on 100 more) and a Delta order for 80 MD-88s, the family grew in stature, and sales blossomed.

The next major improvement to the MD-80 was the MD-90, which saw a change of engines to International Aero Engines (IAE) V2500 turbofans—then the largest and most powerful engines ever rear-mounted on an airliner. This type first flew in 1993 with Delta again as a launch customer. The basic MD-90 model is the -30, which is also built under license in China.

The Boeing 717-200, a reduced size 100–120-seat, short-range airliner powered by BMW Rolls-Royce engines, is the latest in the family. No doubt it will perform as well for Boeing as sales of the DC-9/MD-80/MD-90 performed for McDonnell Douglas.

McDonnell Douglas MD-80 & MD-90 is the fifth book in the Airliner Color History series, a new highly-illustrated series on important civil aircraft. The author is the late Arthur Pearcy, the doyen of aviation writers, known everywhere as Mr. Dakota. One of the great names of aviation writing, he will be sorely missed.

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